# ELECTRICAL REVIEW

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## Electric Light, Power, Telephone, Telegraph and Scientific Progress.

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### VIEWS, NEWS AND INTERVIEWS.

Herr Arnold von Siemens, head of the firm of Siemens & Halske, of Berlin, Germany, was in Chicago recently in connection with the exhibit of the firm at the World's Fair. His interview with Director-General Davis revealed the fact that he proposed to make a very extensive display of the products of his firm.

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The Lewiston, Me., police are greatly bothered in their liquor raids by the electric alarms with which all the saloons of that city are provided, and they propose to arrest the outside loungers who press the button while the bartender "does the rest."

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"The deadly electric car," declares a Boston paper which tells the story with all the solemnity of short-cut paragraphs, "claimed another victim last evening." But as the "victim" fell off the rear platform of the car and sustained a fracture of the skull in falling, it is difficult to see why the "deadly electric" should be specially to blame.—*Providence Journal.*

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"Ben" Abou" recently wrote as follows in the New York *Press:*

Mr. E. L. Babcock, a leading manufacturer and earnest republican, of Ohio, whose business of furnishing electric supplies and machinery takes him widely over the country, said to me yesterday: "The man for us to nominate and be sure of winning the Presidency again is 'Uncle Jerry' Rusk. There wouldn't be a doubtful State west of the Alleghenies that has heretofore been in the republican column with 'Uncle Jerry' at the head of the ticket, and he is the kind of a man that would capture the votes in New York."

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The German traveler in Africa, Dr. Junker, in his new book about his old travels in Africa, repeats his familiar stories concerning the way in which he got along with the natives when he went from Khartoum to the equatorial province in 1879–1883. He did not go there to fight the tribes, and he did not need to slaughter them. He took along with him an assortment of electric toys, musical instruments, picture books, masks, marionette figures, miniature railways and other things of which the natives knew nothing; he entertained the chiefs and their tribes therewith, won their friendship thereby, and became a favorite whose company was sought by the most warlike savages.

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It is reported that the assent of 130,000 shares out of 240,000 shares of the common stock of the Thomson-Houston Company has been received favoring the consolidation with the Edison Company. This is more than a necessary majority of the stock.

### Crocker-Wheeler Electric Company.

The Crocker-Wheeler Electric Company, New York, has just shown a full line of motors, fan and pumping outfits, automatic switches, etc., at the Crystal Palace Exposition, through their agents, the General Electric Company, Limited, of London, and have come out, as usual, with flying colors. It has been the policy in the past for English manufacturers of motors to decry machines of American manufacture, but the General Electric Company have now in writing from Messrs. Crompton and Company, makers of the best English dynamos and motors, that their various attempts at making small motors have been failures when compared with the machines put upon the market by the Crocker-Wheeler Electric Company. They have also made arrangements with the General Electric Company to publish a list of Crompton and Crocker-Wheeler motors. One portion of the list will deal entirely with the Crocker-Wheeler motors and on the frontispiece they state that they have taken up their sale by special arrangement with the General Electric Company who are the sole representatives of the Crocker-Wheeler Electric Company in London. This is a great victory for goods of American manufacture. The Crocker-Wheeler motors are standard machines in this country, and we are glad to see that their reputation has spread abroad.

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The Edison Electric Light Company has brought suit against the Louisiana Electric Light Company, alleging infringement of the Edison lamp patent.

### Brush Electric Company's Plant.

Among the leading industries of Cleveland, Ohio, and, in fact, prominent among the large manufacturing concerns in the electrical field throughout the country, whose growth and development have been so marvelous during the past decade, the Brush Electric Company is entitled to special mention. The most casual observer cannot fail to be impressed, while looking over an establishment such as this, with the perfection already attained, not only in the electrical appliances themselves, but also in the mode of their manufacture.

In no other science, has such rapid progress been made during the same length of time, in this or any other country, as has been accomplished by electrical men during the past ten years, and the American people have good reason to be proud, not only of their inventors, but of the progressive business men, whose energy and enterprise have enabled the electrical industry to keep so fully abreast of the tremendous demands made upon it.

In this connection, a brief description of the works of the Brush Electric Company, some interior views of which are presented herewith, may prove interesting.

The plant, as at present constructed, including the carbon works, covers about seven acres of ground, and furnishes employment to 750 men.

Extensive additions and alterations, made necessary by the increasing volume of business, are now under way, and the works present the sight of a veritable bee-hive of industry.

FIG. 1.—ARMATURE WINDING ROOM, BRUSH ELECTRIC COMPANY, CLEVELAND.

Entering the main building from the street, if fortunate in the possession of credentials satisfactory to the vigilant doorkeeper, you find yourself in a series of comfortably fitted up offices, devoted to the use of the superintendent, assistant superintendent and purchasing agent.

From these offices a door opens directly on the floor to the main machine shop, and the view from here is well worth a careful inspection.

This room is 120 feet wide by 264 feet long, and as far as the eye can reach it encounters row after row of intricate machinery of all shapes and sizes, and a perfect maze of belts and pulleys.

On this floor alone, there are 328 pieces of machinery, and 350 men are constantly employed here. This room is lighted by 50 arc and over 300 incandescent lights. Standard gauge railroad tracks traverse it in various directions, and platform cars fitted with 20 horse-power Short motors are now being constructed, on which heavy castings and machines can be loaded from any part of the works, and carried to and from the cars of the Cleveland & Pittsburgh Railroad, whose sidings run through the yard.

Toward the further end of the building, and occupying a space 50x150 feet, uprights are being put into position and tracks laid for a traveling electric crane, now being built by the Morgan Engineering Company. This crane will have a lifting capacity of ten tons, and will be operated from a street railway circuit of 500 volts.

Near at hand, and directly alongside of one of the tracks, is one of the largest planing machines in the country, and the first one of its size ever built. This machine has a planing surface of 10x7 feet, and weighs 80,000 pounds. It is used only on very large castings, such as 200 horse-power Short generators for street railway work. It was made expressly for the Brush Company, and probably earns more money than any other single machine in the works.

A large number of the smaller machines on one side of the shop are run from a separate shafting, power being furnished by a 20 horse-power Short motor.

The testing room occupies a space 35x60 feet on this floor, and has facilities for testing 10 machines at a time. Power is supplied by a 250 horse-power direct coupled compound engine, and the shaft is fitted with Falls Rivet and Machine Company's clutch

pulleys, so that any machine may be cut out at will.

On the opposite side of the building, and covering a space 35x50 feet, is the arc lamp assembling department.

Adjoining this, and occupying a space 35x130 feet, is the brass department, and here all the brass work of whatever kind is turned out. There are 100 pieces of machinery used in this department alone.

In the rear of the machine shop is the engine and boiler room. The power for the main shafting is furnished by two Wright engines, each of 200 horse-power, coupled to the same shaft, and having the driving wheel between them. This wheel is 16 feet in diameter, and has a four-foot belt surface. The boiler room is 56x40 feet, and at present contains three boilers of 120 horse-power each, fed by fuel oil under forced draught. Two Stirling boilers of 250 horse-power each are now being put in.

The tool room is another important feature of the works, and is very complete in all its appointments. Fifteen tool-making machines are in use here, and all the tools used in the shop are made right on the ground. Adjoining the tool room is the department where the switchboards, rheostats and compounding coils are turned out.

Upstairs, and over the offices of the superintendent and his assistants, is the drawing room, which is fitted with every modern appliance, and contains a dark room for photographic work, which is literally "out of sight." Here are to be seen some handsome specimens of blue prints taken by electric light. Eight draughtsmen are employed here, and the representative of the REVIEW was afforded an opportunity of seeing the original drawings of a new 350 horse-power generator for general power purposes which is now under way. This is a six-pole machine and will be a monster. The main frame will be in one piece, 13 feet two inches long by five feet 11 inches high, and will weigh 18,000 pounds. The width at the base is 50 inches, and the total weight of the machine will be 17 tons. Orders for three of these machines are already placed.

Adjoining the machine shop, and separated from it by a 25-foot driveway, is what is known as the cathedral building. This is 100 feet wide by 200 feet long, and three stories in height. The center is a vast dome, the second and third floors being virtually wide galleries running round it. The main portion of the ground floor is devoted exclusively to street railway work, the manufacture of machines for the Short Electric Railway Company being a very large and important branch of the business. Here may be seen the celebrated gearless and single reduction motors in every state of construction, from the bare casting of the frame to the completed machine mounted on the trucks of the cars. Fifteen generators of 150 horse-power each are now in hand. There are 36 pieces of machinery used in this work, many of which are marvels of mechanical skill.

In one end of this building is the shipping department and the offices of the shipping clerks and timekeepers, and a separate department for the manufacture of rheostats.

Adjoining the other end, and separated from the main building by a solid brick wall, is the engine and testing room for large generators. This room is 40x60 feet and contains a 400 horse-power Cummer engine with an 18 foot driving wheel.

Next is the alternator testing room, 60x63 feet, containing switchboards for 600 lights and large wire coils for additional loads. Power is furnished by a Greene automatic engine of 100 horse-power.

The boiler room, which is 50x103 feet, comes next, and here also is located the brass foundry, the company making all their own castings of this description.

The second floor of the cathedral building is used for winding all kinds of armatures and magnets. There are between 50 and 60 men in this department aside from a large annex extending the entire width of the building, also used for winding, and containing converters and facilities for erecting extra large switchboards.

The third floor is used as a storeroom for unfinished parts and stock.

There is still another building, 40x180 feet and two stories high, the ground floor of which is used as a stock room and the upper floor as a carpenter shop and pattern room.

The general offices of the company are located in a handsome two story brick building, surrounded by spacious grounds, on the opposite side of the street from the works, and are fitted up in the most elaborate manner, both as regards interior furnishing and decoration, and accommodation of the large clerical force employed.

The offices of the Short Electric Railway Company adjoin, and occupy a building of similar size and style.

## A Fine Exhibition of the Northern Lights.

Electricity in a rather unusual form was responsible for considerable interest and excitement in this city and vicinity on Saturday evening, February 13, and furnished one of the most magnificent displays of electric lighting seen in many years.

Shortly after seven o'clock an alarm of fire was turned in from the lower part of the city, and while the engines were hastening to the scene, the heavens were suddenly illuminated by a deep red glow which grew rapidly brighter, and spread and deepened until to the eyes of the excited thousands in the streets it appeared as though half the city was in flames.

The firemen themselves were deceived and turned in a second and a third alarm, and so vivid was the impression in Brooklyn that New York was being devoured by flames, that the fire department telegraphed to headquarters in this city offering their assistance.

Fortunately, however, the cause was not of so serious a nature, being merely a beautiful electrical display; in fact, the Aurora Borealis, the beauties of which are seldom seen to such advantage in our latitude. The Northern sky was hung with long banners of fire, and a soft, ruddy glow spread gradually over the heavens until it reached the zenith, when it began to soften to a rosy pink and great bands of white light spread out vertically from the horizon. The part of the heavens not touched by the illumination took on, by contrast, an ebony blackness, and from this background the vivid colors showed to the best possible advantage.

So powerful was the electric current, that at times no battery was necessary for transmitting messages by wire, and several times during the evening messages passed between New York and Albany borne on the electric wave.

## Electricity in a Modern Residence.

BY H. WARD LEONARD.

### USES.

The uses of electricity in a residence may be treated under the following heads:

1. Electric lighting.
2. Electric power.
3. Electric heating.
4. Electric bells, annunciators, etc.

### ELECTRIC LIGHTING.

The incandescent lamp is without dangerous heat, is free from odor, absolutely clean, and is controllable at the lamp or from a distant point if desired. Hence, the lamps may be placed anywhere desired, and we are not limited, as with gas, to a rigid fixture placed in the midst of a large space, and with the lights all necessarily pointed upward.

The lamps can readily be placed upon the ceiling or walls, or in recesses made in them for the purpose. The fixtures can be made of any conceivable design, and lamps of any candle power and color be placed in any position upon them.

In lighting a residence, we should dismiss from our minds all preconceived notions based upon the use of gas and oil.

Where do we want light? How much? Of what character? and where controlled from? Make such a specification and give it to a concern experienced in such electrical construction work, and the desired result will be obtained in every case.

If we have outside lights they will be unaffected by the weather, and controlled from just inside the door. Lights in a stable will be controlled either from the house or stable at will. Lights in a cellar or dark basement will be controlled by a switch placed at the entrance, so that the lamps will be lighted before we enter, and extinguished when we have left.

Every bedroom, closet, storeroom, etc., will be lighted by a lamp which lights up automatically as we open the door, and is extinguished when the door is closed. The convenience of this advice can only be appreciated by those who have had experience with it. In many places in the house we will have a lamp which can be operated either at full candle power or at a very much reduced candle power at will.

In the parlors we will have all the beautiful effects produced by piano lamps, banquet lamps and fairy lamps, without any of the present accompanying care, danger, heat and disagreeable odor.

Every room will have a switch placed beside the doorway, so that the lamps can be most conveniently controlled by a person entering or leaving the room.

In such a house the most timid child, of but a few years, will go anywhere with safety and without fear, lighting and extinguishing the lamps as desired.

The lamp bulbs will be clear, frosted, colored or opalescent, as occasion requires. We will have, in every place desired, the softest, steadiest and coolest light obtainable.

The most beautiful effects can be obtained in the dining room and upon the dinner table. Electric candelabra can, if desired, be used, which will be identical in appearance with those using candles.

Pictures can be lighted in a manner entirely impossible with gas.

The most delicate and beautiful colors in paintings and decorations retain indefinitely their original beauty, since the bleaching and blackening effects of gas are entirely absent.

It is probably but little appreciated, but entirely true, that the greatest expense due to the use of gas in a handsome residence is the depreciation it effects upon the costly materials in the residence, rather than the bill for the gas itself.

A few years ago there was a probability that the wiring of a residence would, in the future, fail or prove unsuited to the system of lighting which it would be desired to use. This condition of affairs does not now exist. The commercial systems of electric lighting have become as fixed, as regards the interior wiring, as have the gas systems; and to-day it is possible to wire a building for electric lamps with a much greater certainty that the result will be permanent, satisfactory and suited to future use than is possible in the case of gas piping.

If the building is not to be lighted for some time, it should be equipped with a system of insulating electric conduits which make it possible to draw in any wires desired at any time in the future, or to replace wires previously drawn in.

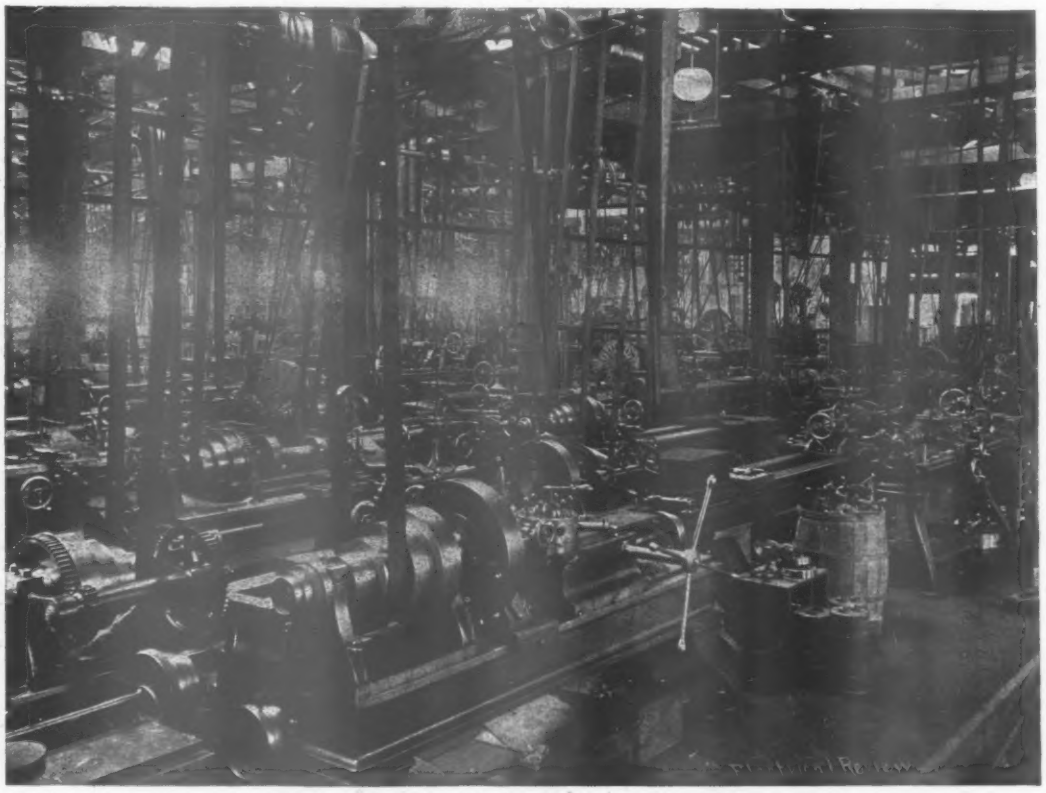

FIG. 2.—VIEW IN MAIN MACHINE SHOP, BRUSH ELECTRIC COMPANY, CLEVELAND.

### COST.

The first cost of wiring varies widely. An average figure will be about two dollars and a half a lamp; but in some instances it will be as low as one dollar and a half per lamp, and in others as high as four dollars per lamp. It will rarely exceed these figures when a residence is wired throughout.

The charge for current is, for the same result, about the same as gas. The current used can be accurately recorded by an electric meter; hence, the bill will be exactly proportional to the consumption of current.

### ELECTRIC POWER.

The most conspicuous and important application of electricity for power purposes in a residence is for operating an elevator. It is possible to-day to have in a residence an electric elevator which is reliable, simple, safe, convenient and economical to operate.

There is no engine, pump, tanks, pipes, valves and the multiplicity of devices which are required for the steam or hydraulic elevator.

There is no noise, heat nor smell accompanying its use, and it is always ready to operate, and can be operated with perfect safety by a child.

There is no hand rope, the control being effected by the movement of a small electric switch in the elevator car itself.

The motion of the elevator is perfectly smooth, and it can be made to go at any speed in either direction. It is automatically

stopped at the top and bottom floors, and no accident can occur, even though the electric supply should fail entirely.

An elevator boy is unnecessary, as the elevator can be controlled from any floor and brought to the desired floor, when the elevator door can be opened, but not until then. While the elevator door is open it is impossible to operate the elevator from any of the floors, so that there is no danger of any movement of the elevator, while a person is getting in or out of it.

The first cost of such an elevator will be from $2,000 to $3,000. The expense for the current for operating it will, in ordinary instances, not exceed $5 per month, and the cost of maintenance will be but a few dollars per year, as it is entirely simple, and requires almost no attention.

No greater luxury than a passenger elevator can be placed in a residence; and it has been only very recently that such a luxury could be provided; for, in the case of a hydraulic elevator, the water for which was pumped to a tank above by means of a steam engine, gas engine or electric motor, the complication and expense of attention and maintenance was practically prohibitory, and the unreliability very annoying.

Many complex methods of operating directly by an electric motor have hitherto been attempted, and many are still upon the market; but in order that an elevator shall be worth having in a residence, it must be entirely free from complex apparatus and must be always reliable, simple and smooth in its operation, and it has been only very recently that a direct method of operation has been developed which is free from the complication of rheostats, brakes, solenoids, etc., which have characterized the electric elevators heretofore, and rendered them uncommercial except in expert hands.

Other applications of power in a residence are the operation of dumb waiters, small ventilating fans, ice cream freezers, the pumping of water, etc.

The dumb waiter will need a motor of perhaps ¼ horse-power, costing, with its gearing, perhaps $150. A small electric ventilating fan will cost about $25 complete. An ice cream freezer will require a quarter or half horse-power motor, and will cost complete from $100 to $200. An automatic electric pump will cost about $200.

The expense of operating all of these convenient devices will probably not exceed $50 per year, even when used a great deal.

ELECTRIC HEATING.

Heating by electricity is, generally speaking, the most extravagant luxury obtainable from its use. Hence the heating of large spaces continuously would be out of the question, except where power has but little value.

But when we wish a perfectly controlled, safe, instantaneous heat for occasional use, we can obtain it readily, conveniently and economically by the electric current.

For instance, electric flat irons can be operated in a most satisfactory manner by making connection in any incandescent lamp socket. The flat iron, in a few seconds, reaches a sufficient, but not scorching, heat, and remains at this heat continuously. The cost of the flat iron is but a few dollars, and the cost of operating about five cents per hour.

Various cooking operations, such as boiling eggs, making coffee, cooking batter cakes, etc., can be performed in a most perfect and convenient manner, and the development of the uses of electric heating for cooking operations will be very rapid in the immediate future.

ELECTRIC BELLS, ETC.

With the introduction of the incandescent light into a residence the nuisance of inoperative electric bells ceases. Having a constant source of electric supply we are no longer at the mercy of the battery which has "run down;" nor will we need the high-priced services of the so-called electrician, who has been with us so much in the past.

In a residence having incandescent lamps, our electric bells, annunciators, etc., will be always perfectly reliable, and will require no attention whatever for an indefinite period.

COUNTRY RESIDENCES.

A few residences in this country are supplied with individual electric plants. But, aside from the first cost, the care and expense of maintenance has made such instances very rare.

It is now possible to utilize a windmill for an isolated residence plant, so that in an extremely simple manner the windmill will produce electricity for lighting, operating an elevator, chopping feed, sawing wood, etc., etc.

A small storage battery is used to provide means of keeping up the service when there is no wind.

The great difficulty has heretofore been to govern the windmill, and many unsuccessful attempts have been made in this line.

The present and successful method, however, makes no attempt to govern the windmill; but in a very simple manner provides means so that, whether the windmill goes fast or slow, the dynamo for the incandescent lamps is operated at a constant speed; and hence, maintains the lamps at a constant candle power.

The cost of equipping a country residence with such an electric plant complete, with wiring, windmill, dynamo, storage batteries, etc., is about $1,500, and the expense of operating will be almost negligible. Where several residences are lighted from one such plant, the cost per residence can be made much lower than the figure given.

The safety, convenience and adaptability to use for any lighting or power will make such plants very numerous in the immediate future, especially along the sea coast, where the wind is more reliable than inland, and where, therefore, the size of the storage battery can be extremely small, and its use only exceptional.

### An Important Contract.

The Short Electric Railway Company, of Cleveland, has been fortunate in securing from the Minneapolis Street Railway Company an order for their entire Spring requirements. It will be remembered that this road is one of the largest in the country. In the extensions to be made this Spring, the Minneapolis company found it necessary to purchase 120 motors, and made a careful investigation of the latest types of motors as made by the leading electrical companies, finally selecting the Short gearless motor as embodying all the best features for modern electric railway practice. The motors are to be in operation by April.

FIG. 3.—VIEW IN MACHINE SHOP, BRUSH ELECTRIC COMPANY, CLEVELAND.—(See other illustration, Page 9.)

**Oconto, Wis.**—Standard Lamp and Motor Company; capital, $50,000.

**Denver, Colo.**—The Electric Reciprocating Company; capital, $250,000.

**Connellsville, Pa.**—Connellsville Electric Railway Company; capital, $100,000.

**Parkersburg, W. Va.**—Home Lighting and Fuel Company; capital, $250,000.

**East Grand Forks, Minn.**—Red River Valley Railroad Company; capital, $100,000.

**New York City.**—Ogden Electric Power Company; (incorporated in West Virginia); capital, $500,000. Promoters, W. S. Morrow, Westfield, N. J.; J. W. Snedeker, Bloomfield, N. J., and J. A. Kittin.

**Constantine, Mich.**—Constantine Electric Company; Capital, $6,000. Promoters, Levi Hull, Franklin Wells, John J. Proudfit, all of Constantine, Mich. Incorporation papers sent to Levi T. Hull, Constantine, Mich.

**Pekin, Ill.**—City of Pekin Electric Light and Power Company; capital, $15,000. Promoters, John R. Seibert, George Herget, Jacob A. Roelfs, Thomas Cooper, L. Zinger. Incorporation papers sent to city clerk, Pekin, Ill.

**Fort Worth, Tex.**—The Arlington Heights Electric Light Company; capital, $100,000. Promoters, H. W. Fallant, W. C. Winthrop, Robert McCart, S. B. Paxton. Incorporation papers sent to Robert McCart, Fort Worth, Tex.

**The Dalles, Ore.**—The Dalles Electric Telephone and Power Company; capital, $40,000. Promoters, G. V. Bolton, H. C. Wilson, George C. Blakeley and George Rush. Incorporation papers sent to W. H. Wilson, The Dalles, Ore.

**Duluth, Minn.**—Northern Electric Subway Company; capital, $100,000. Promoters, N. J. Miller, C. R. Haines, R. M. Hunter, all of Duluth, Minn. Incorporation papers sent to Cush, Williams & Chester, Duluth, Minn.

**Worcester, Mass.**—Quinsigamond Electric Power and Light Company; capital, $10,000. Promoters, Horace H. Bigelow, Irving E. Bigelow and Eben F. Thompson. Incorporation papers sent to Eben F. Thompson, Worcester, Mass.

**Milton, Pa.**—Milton Electric Light and Power Company; capital, $40,000. Promoters, Ed. D. Mullen, Frank Rheu, Philadelphia, Pa.; Levi E. Snow, Milton, Pa. Incorporation papers sent to L. E. Snow, 509 Arch street, Philadelphia, Pa.

**Springfield, Ore.**—Springfield Electric Light Company; capital, $10,000. Promoters, J. C. Boyd, George H. Thurston, B. J. Pengra, A. Mande, M. L. Wilmot, all of Springfield, Ore. Incorporation papers sent to B. J. Pengra, Springfield, Ore.

**Eldora, Ia.**—Eldora Electric Light Company; capital, $15,000. Promoters, W. S. Porter, C. E. Albrook, J. H. Smith, C. E. Greef, J. E. Hardin, J. D. Newcomer and E. K. Brown, all of Eldora, Ia. Incorporation papers sent to C. E. Albrook, Eldora, Ia.

**Negaunee, Mich.**—Negaunee and Ishpeming Electric Light Company; capital, $20,000. Promoters, Alex. Maitland, John B. Maas, Negaunee, Mich.; H. C. Young and J. Jones, Ishpeming, Mich. Incorporation papers sent to John B. Maas, Negaunee, Mich.

**St. Paul, Minn.**—Mitchell Electric Company; capital, $15,000. Promoters, H. M. Byllesby, H. C. Levis, W. Bromhall, B. T. Muh, Jr., W. P. Johnson, C. K. Stearns, S. P. Wells, Jr., all of St. Paul, Minn. Incorporation papers sent to H. C. Levis, 401 Sibley street, St. Paul, Minn.

**Columbus, Kan.**—The Kansas, Miami and Southern Railway Company; capital, $200,000.

**Chicago, Ill.**—Central Electric Light and Power Company; capital, $500,000. Promoters, R. T. McDonald, W. H. Harding, W. J. Buckley. Incorporation papers sent to Hon. Geo. Driggs, R-227 Court House, Chicago, Ill.

**Lower Chichester, Pa.**—The Lower Chichester Electric Light, Heat and Power Company; capital, $1,000. Promoters, Jno. H. Kerwin, Linwood, Pa.; Thos. H. Berry, Chester, Pa.; H. F. Walter, Media, Pa. Incorporation papers sent to E. H. Hall, Media, Pa.

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CONTENTS.

| | PAGE. |
|---|---|
| Views, News and Interviews | 1 |
| Crocker-Wheeler Electric Company | 1 |
| Brush Electric Company's Plant | 1 |
| A Fine Exhibition of the Northern Lights | 2 |
| Electricity in a Modern Residence | 2 |
| An Important Contract | 3 |
| New Corporations | 3 |
| The Electrical Press | 4 |
| Competition in the Electrical Business | 4 |
| Correspondence: | |
| Our Boston Letter | 5 |
| Our Chicago Letter | 5 |
| Our San Francisco Letter | 5 |
| Our Indianapolis Letter | 5 |
| Press Club Dinner | 5 |
| American Institute of Electrical Engineers | 5 |
| California Electrical Society | 5 |
| Popular Lecture at the American Institute | 5 |
| Personal | 5 |
| Telephonic News | 6 |
| Interior Conduit and Insulation Company's New Switch | 6 |
| My Reminiscences of Lincoln | 6 |
| Telegraphic | 7 |
| Cutter's Lamp-Supporting Pulley | 7 |
| Electric Power | 8 |
| Bunnell's Adjustable Extension Sounder Support and Resonator | 8 |
| New Edison Transformer | 8 |
| Edison Elevator Controller | 8 |
| Electric Signals to be Used on the Northwestern Road | 9 |
| Electric Light News | 9 |
| On the Law of Hysteresis | 10 |
| Literary | 11 |
| The Electric Special | 12 |
| The Edison-Thomson-Houston Consolidation | 12 |
| Queen & Company's New Thomson Reflecting Galvanometer | 12 |
| N. I. R. Seamless Insulation | 12 |
| The Evans Friction System of Driving Dynamos | 12 |
| Holtzer-Cabot Apparatus | 13 |
| Electric Heating | 13 |
| "C. & C." Electric Coal Cutter | 13 |
| Kindred Interests | 14 |
| Electrical Patents | 14 |

INDEX OF ADVERTISERS.

| COVER PAGES. | PAGE. |
|---|---|
| American Electrical Works | i |
| Ansonia Brass & Copper Co. | xxii |
| Armington & Sims | xxii |
| Bridgeport Brass Co. | xxii |
| Crocker-Wheeler Motor Co. | i |
| Day's Kerite Insulated Wires | xxii |
| Eastern Electric Cable Co. | xxii |
| Eastwood, Benj. | i |
| Eddy Electric Mfg. Co. | i |
| Gleason Mfg. Co., E. P. | i |
| Hampson & Co., E. P. | xxii |
| Jewel Belting Co. | xxii |
| Johns Mfg. Co., H. W. | xxii |
| Keasbey, Robert A. | xxii |
| Link Belt Engineering Co. | i |
| Moore, Alfred F. | xxii |
| Noye Mfg. Co., John T. | xxii |
| Okonite Co. | i & xxii |
| Simplex Electrical Co. | i |
| Wainwright Mfg. Co. | i |
| Wallace & Sons. | i |
| Weston Engine Co. | i |
| Wilmot & Hobbs Mfg. Co. | xxii |

INSIDE PAGES.

| | |
|---|---|
| Allis & Co., Edward P. | xii |
| American Bell Telephone Co. | xvii |
| American Casualty Insurance and Security Co. | xvi |
| American Electric Elevator Co. | viii |
| Baker & Co. | vi |
| Barnes Co., W. F. & John | viii |
| Barrett, John A. | 14 |
| Beacon Vacuum Pump and Electrical Co. | iii |
| Belden Mica Mining Co. | 14 |
| Belknap Motor Co. | xvii |
| Benedict & Burnham Mfg. Co. | iii |
| Bishop Gutta Percha Co. | xiii |
| Brill Co., J. G. | viii |
| Bristols Mfg. Co. | iii |
| Brush Electric Co. | xi |
| Buckeye Engine Co. | viii |
| Buffalo Engineering Co. | xxi |
| Burton Electric Co. | viii |
| "C. & C." Electric Motor Co. | xix |
| Cary, Alanson | xvi |
| Central Electric Co. | iii |
| Church & Sleight | viii |
| Consolidated Electric Mfg. Co. | xiii |
| Cralle & Co., J. B. | viii |
| Cutter, George | 14 |
| Dixon Crucible Co. | xiii |
| Douty, H. W. | vi |
| Dwight Slate Machine Co. | viii |
| Edison General Electric Co. | iv |
| Edson, Jarvis B. | iv |
| Electric Secret Service Co. | x |
| Electro-Light Engraving Co. | viii |
| Elektron Mfg. Co. | xii |
| Empire China Works | xii |
| Evans Friction Cone Co | xii |
| Falls Rivet & Machine Co. | vii |
| Faraday Carbon Co. | viii |
| Fletcher & Fletcher Electric Co. | viii |
| Fort Wayne Electric Co | xx |
| Garvin Machine Co. | viii |
| Globe Co. | viii |
| Greeley & Co., The E. S. | x & xix |
| Haines, Jones & Cadbury Co. | xvii |
| Hall Signal Co. | v |
| Harrisburg Foundry and Machine Works | xiii |
| Heisler Electric Co. | x |
| Hill Clutch Works | vii |
| Hill Electric Co., W. S. | vi |
| Holmes, Booth & Haydens | xix |
| Hummler, Aug. | 14 |
| Imperial Porcelain Works | x |
| Independent Bung Co. | x |
| Ladd, Alfred W. | viii |
| Lane & Bodley Co. | vi |
| Law Telephone Co. | 14 |
| Leclanche Battery Co. | xiii |
| Leffel & Co., James | xvi |
| Lehigh Valley Creosoting Co. | viii |
| Leonard & Co., H. Ward | viii |
| Marsh, James A. | 14 |
| Marshall, Wm. | x |
| Merchant & Co. | xvii |
| McCreary Electrical Specialty Co. | viii |
| National Electric Mfg. Co. | xv |
| National India Rubber Co. | xii |
| New England Butt. Co. | xvi |
| New York Insulated Wire Co. | vi |
| New York & Ohio Co. | xvii |
| New York Belting and Packing Co | viii |
| New York Safety Steam Power Co. | vi |
| Ostrander & Co., W. R. | viii |
| Paiste, H. T. | xiii |
| Phœnix Glass Co | xix |
| Phosphor-Bronze Smelting Co., Ltd. | viii |
| Prentiss Tool & Supply Co. | 14 |
| Queen & Co. | xii |
| Reddaway & Co., F. | viii |
| Ridlon & Co., Frank | 14 |
| Royce & Marean | viii |
| Sargent, J. B. | 14 |
| Sawyer-Man Electric Co. | xvi |
| Schieren & Co., Chas. A. | 14 |
| Short Electric Railway Co. | xii |
| Schuyler Electric Co. | vii |
| Solar Carbon & Mfg. Co. | xvii |
| Somoff, J. L. | vi |
| Sperry Electric Mining Machine Co. | xiii |
| Standard Paint Co. | vi |
| Stanley Electric Mfg. Co. | xiii |
| Thomson-Houston Electric Co. | xx |
| Truex & Vail | viii |
| Tyndall, Wm. D. | vi |
| Waddell-Entz Electric Co. | viii |
| Walworth Mfg. Co. | iii |
| Washburn & Moen Mfg. Co. | xix |
| Watson & Stillman | xvi |
| Western Electric Co. | xvi |
| Weston Electrical Instrument Co. | xvii |
| Westinghouse Electric & Mfg. Co. | vii |
| Wheeler Condenser & Engineering Co. | xvi |
| Williams & Potter | viii |
| Wood, Jr., John | viii |
| Woodhouse & Rawson | x |
| Wyckoff, Seamans & Benedict | 14 |

To the electrical people assembled in Buffalo at the Fifteenth Convention of the National Electric Light Association, the ELECTRICAL REVIEW presents its birthday greetings, and hopes that a decade of even greater progress than the one just completed and chronicled in our Decennial Number, last week, will be now inaugurated. This convention will undoubtedly be the most successful and practical meeting in the history of this Association, which has grown in strength and influence until it is a great power in the land. May each individual attending the sessions reap much personal profit.

Mr. Nikola Tesla's reception in London has partaken of the nature of an ovation, and the English electrical press is filled with enthusiastic comments upon his lecture at the Institution of Civil Engineers. All the praise showered upon him is well deserved and must be most gratifying after his many hours of patient toil and research.

In France, Mr. Edison's proposed shocking water scheme applied to warfare is termed, *le clyso-pompe*, and a writer in an English newspaper now christens it, "The Water Baby," in contradistinction to the "Woolwich Infant." Let someone else try.

With the increasing success in the transmission of power for commercial uses in the various parts of the country, especially in the West, the time cannot be very far distant when electricity will be applied as a motive power to agricultural operations in those districts where they are performed on a large scale and where steam is used at present. The storage battery will doubtless find a large application in this work for supplying field motive power, and to the practical inventor there is great opportunity for the exercise of his ingenuity in working out the details of electrical agricultural implements and appliances. The power will soon be at the gate of the farmer; it remains to make use of it in the simplest, most direct manner. Let the electrical engineer now rack his brain to accomplish the task which will be of so much benefit to the agrarian interests.

## *THE ELECTRICAL PRESS.*

The advantages to the layman arising from a practical knowledge of the laws and applications of electricity are, in these days of its use in so many of the operations of daily life, beginning to be quite fully appreciated. This fact is recognized by the daily press, and extracts from the technical journals, as well as original articles, are now to be found quite generally in its columns; indeed, of late, the larger papers find it a necessity to employ, as members of their staffs, editors who are conversant with this subject. The desire for information on what is being done by the workers in the electrical field has grown apace, and as a result the diffusion of electrical knowledge among the people has been most marked.

This has had its natural effect, that of clearing away those fears and prejudices which have always accompanied the early use of any form of natural force. In the early days of the application of electricity to industrial uses, the pioneers and the electrical press, hand in hand, fought a hard battle, and when we look back upon the fierce opposition met, the ignorance combatted and the many obstacles overcome, the present status of the art appears as phenomenal as it is gratifying. The work done by the electrical press in conserving the work already done, in inciting to further endeavor, in giving to the public the fallacies in argument of opponents, and in exposing the misrepresentation of hostile interests, finding voice in journals whose columns were open to the enemies of commercial electrical progress, can only be fully appreciated by those who fought in the ranks or carefully watched the struggle through those years of uncertainty and discouragement.

Step by step was a firm foothold gained, and one by one were doubts dispelled, until at length the banner of progress was solidly planted on the walls of the captured goal and the *Electrical Era* had begun. History has only repeated itself in this case, as it has so many times before, with innumerable variations, but with the same persistency, modified more and more by the greater general diffusion of knowledge among the masses.

Looking back to the early struggles of all scientific progress, we find the same spirit of opposition to innovation, the same unreasoning prejudice, typified in that period when the *savant* of Europe was compelled to seek refuge in Holland and Switzerland that he might give voice to his discoveries. In no domain do we find the powerful influence of a free press more marked than in that of science, and it is safe to assert that the present commanding position of the electrical arts would have been many years deferred had it not been for the great work done by the electrical journals of the day. Nor has their mission been fulfilled; a great work remains to be done in carrying to the public the tidings of new tasks accomplished and in preserving the history of the art. One by one, as the years passed by, the ELECTRICAL REVIEW has been joined by its contemporaries, until to day we feel justified in asserting that the electrical press equals in brilliant, worthy representatives, the press of any branch of the arts or sciences.

## *COMPETITION IN THE ELECTRICAL BUSINESS.*

Competition in the electrical business has been, in the past, as severe as in any field of manufacturing, in fact, we may go further and assert that it has been much more uncompromising than in any of the older branches of trade, where the cost of manufacture and of placing goods in the consumers' hands has from years of experience become a less variable quantity, subject to but fewer and well known causes of fluctuation.

The idea that all investments in the electrical arts were proving fabulous bonanzas early possessed the mind of the speculative capitalist, and soon the field was packed with a host of new concerns intent on reaping a golden harvest in the shortest space of time regardless of the character of their products or of their methods of procedure. "There were millions in it," and the market was soon flooded with every character of electrical devices, all striving to get in first and have a long list of references, even if it became necessary to give goods away with a bonus. It was a repetition of the well known rivalry between the steamship lines plying between certain ports of Scotland and Ireland where, in order to capture the travel of farm laborers during the harvest, competition finally reached such a point that a passage was given free and then the beneficiary complained because supper was not thrown in.

This state of affairs continued, and even some of the more conservative companies were drawn into the whirlpool. The natural result has followed this ruinous policy, the weaker concerns dropping out one by one, whilst the larger ones poured thousands into the bottomless well. The boom continued, notwithstanding, and the idea of enormous profits still persisted. New companies sprung up, lived for a day and disappeared, but the effect on the market was sadly hurtful.

At length a few of the wiser corporations called a halt, began to consider the cost and set themselves the task of working out a reasonable profit by improving the quality of their goods and placing them upon the market on their merits at a price based upon the cost of manufacture; adding a living profit. The wild career upon which the majority had entered was continued to its natural end, and to-day we see the business largely in the hands of those conservative few that had the firmness to cry quits and shape their policy upon true business principles. The recent consolidation of the interests of two of the large companies, with the management which the combination is quite certain to have, will, without doubt, tend to keep prices on a basis where a reasonable return can be made upon the capital invested, and we may now look forward to an era of solid prosperity much in contrast to the days of wildcat speculation of the past.

With the wide field opening up in all branches of the application of electricity to public and domestic uses, especially in the transmission of power, traction, heating, etc., electrical securities will surely become more and more popular, and the public will reap a substantial benefit in the bringing to the door of the home and the workshop the many advantages of larger possibilities in the application of the power of electricity o the wants of man.

There is talk of putting a fleet of electrically propelled launches on the lagoons at the Chicago World's Fair, and we trust the scheme may be carried out. There has been but little done in this country in a commercial way in this line, whilst in Europe, on the Thames in particular, we find the electric launch in every-day use, and operating with gratifying success, electrical, mechanical and, to crown all, financial. Here is a field for enterprising capitalists in this country. The harbor, sound and rivers about New York, as well as the many pleasure lakes near the larger cities where current is available, offer a wide field and a paying one to the investor.

# CORRESPONDENCE.

## OUR BOSTON LETTER.

**The Consolidated Electric Motor Company,** until a week ago located at No. 95 Milk street, this city, has removed to more extensive quarters at No. 77 Bedford street.

**The Simplex Electrical Company,** of this city, are in receipt recently of several very large orders for T. Z. R. wire No. 1, insulation for feeders, primary mains and arc circuits.

**Messrs. Habinger & Poole,** of New Haven, Conn., is the name of a new firm recently established in the electrical business. The manufacture of dynamos, motors and other electrical apparatus will be entered into on an extensive scale.

**Mr. Francis R. Hart,** electrical engineer, delivered a very interesting and comprehensive lecture before the Architectural Club, of this city, on Wednesday evening, February 3. The subject of the lecture was: "Electric Lighting of Buildings."

**Beacon Incandescent Lamps,** manufactured by the Beacon Vacuum Pump and Electrical Company, of this city, are meeting with a large sale, and the lamps already in use are spoken of in very complimentary terms as regards quality, brilliancy and efficiency.

**The American Circular Loom Company,** of this city, is exhibiting its new flexible tubing with lead jacket for underground and submarine use. The importance of this product will be at once recognized by all in search of a durable and cheap conduit for underground wiring.

**Josiah Gates & Sons,** of Lowell, Mass., have received the contract of the Lowell and Suburban Street Railway Company for their new power station, 360 feet 46 inch double belting, to be used in three belts; also 136 feet 30 inch double belt for the Public Works Company, Veazie, Me.; 78 feet 25 inch double belt for the St. Albans Electric Light Company, St. Albans, Vt.; and large orders for the Cannon Manufacturing Company, Concord, N. C., and Columbia Manufacturing Company, Columbia, Ala.

**Improved Electric Service.**—Advices from Haverhill, Mass., under date of February 9, are as follows: "Within a few months we will have one of the most extensive and complete plants for the production of light, heat and power from electricity in Essex county. Plans by the Haverhill Electric Light Company have been finished for the new works on Walter street. Nearly all the necessary contracts have been awarded, the foundations for the main building have been put in, and work is now progressing on the foundations for the chimney and engine. The main building will be of brick, two stories with cellar and truss roof, and will be built according to factory construction. It will measure, with the boiler house, 176x76 feet.

"All new engines and boilers will be put in, with the exception of one 100 horse-power Ball engine, which will be removed from the present works of the company and used for hoisting and miscellaneous purposes. Three new engines will be built, 250, 350 and 400 horse-power, respectively, to run the electrical machinery. The boilers will be eight in number of 125 horse-power each.

"The dynamos now used by the company, which are for operating arc and incandescent lights and running motors, will be transferred to the new shop, and new ones of equal capacity added as soon as the buildings are ready, thus doubling the productive power of the company, who will be in readiness to double the capacity of the plant again whenever patronage shall demand the increase.

"In addition to other purposes, the company will be prepared to furnish power for street railway operation. The foregoing improvements are making through a large increase of the capital stock of the company."

Boston, February 20. W. I. B.

## OUR CHICAGO LETTER.

**Incorporated.**—Siemens and Halske Electric Company, Chicago; capital, $500,000. Incorporators, O. W. Meysenburg, Edwin F. Bayley and Otis Waldo.

**George Cutter** has been imagining that he can carry a stock of the new interior conduit "Buildite" at his Chicago warerooms. But up to date he has not succeeded in this, as his orders have come in faster than the factory can turn out the material.

**Mr. P. K. Andrews,** representing the J. G. Brill Company, Philadelphia, closed a contract with the Chicago City Railway Company, this week, for 200 tramway cars for their cable line. This is the largest contract ever given by this company, and Mr. Andrews is to be congratulated upon securing it.

**A Fire** occurred Wednesday morning in the factory of the Illinois Electric Lamp Company, No. 173 South Canal street, which was damaged to the amount of $1,000. The company had just finished fitting up their new factory and were about ready to put in the machinery. Fortunately, however, little damage was done, except the delay caused in getting their factory running.

**At the Meeting** of the Chicago Electrical Association, Tuesday evening, F. R. McBerty read a paper calling attention to some noteworthy "Facts About Patents." Later in the evening Mr. J. F. Connor, of *Electricity*, in a paper on "Electrical Journalism," showed the inducements offered to young men by this profession and the severity of its requirements. In the course of the discussion Albert Scheible commented on the need of a heartier co-operation between readers of the electrical journals towards a more widespread interchange of electrical news notes, and the proper moulding of the current opinions on electrical subjects.

**On Monday** evening last, the Chicago Architectural Sketch Club enjoyed the treat of an experimental lecture by Mr. Chas. G. Armstrong, the well-known electrical expert. The electrical apparatus which he had brought for this purpose, rather overshadowed the strictly architectural decorations of their rooms, and prepared the members for a long but interesting talk on electricity in its relations to architects. Mr. Armstrong led the large audience, step by step, to the point where they could see the general principles underlying electrical specifications, proving each point by a suitable experiment. His remarks in regard to incandescent light as compared with gas, and his illustrations of the efficiencies of incandescent lamps, were especially clear and were well appreciated. The discussion following the lecture showed how important the subject of electrical construction work has grown to be for even the young architects, and how few chances they have of obtaining reliable information in this line.

**The Columbian Electric Transmission Company,** of Chicago, is the first in the United States to attempt on a large scale the transmission of electric power. The company was incorporated Tuesday last with a capital stock of $50,000. The incorporators are Gustav Monrath, Charles G. Armstrong and Clarence Griggs, all well-known electrical experts of Chicago. The theory of transmitting great electric power will be carried into execution, and those interested promise in this way to remedy the smoke nuisance. They purpose building a large power house on the Illinois river, at Marscilles, and later at other points where water power may be had, and transmitting the power to manufacturing houses, and for lighting purposes in Chicago.

The company also propose to transmit 1,500 electric horse-power to exhibitors at the World's Fair. It has not as yet been decided whether the alternating or direct current will be used. The scheme was formulated by Mr. Armstrong last Summer. It has been frequently discussed at the Electric Club and all were satisfied of its feasibility. Capitalists have been interested and there is now no doubt but the power house and the line will be built, and if the company is as successful as its members anticipate, the plans will be enlarged and the demand for power will be met by the construction of more power houses and transmitting lines. One-fourth of the capital stock has already been subscribed.

Chicago, February 13. M. J. B.

## OUR SAN FRANCISCO LETTER.

**An incandescent plant** has recently been established at Hotel Del Monte, Monterey.

**The San Francisco and San Mateo** electric road will be in operation by the first of March.

**A company** has been formed to construct an electric railroad between the city of Fresno and the town of Hanford.

**A Recent Fire** in Eugene City, Ore., destroyed the electric light station, leaving the city in darkness. New dynamos have been ordered and will arrive in two weeks.

**A suit** to recover $500 delinquent taxes has been commenced in the Superior Court by the city and county of San Francisco against the Western Union Telegraph Company.

**A new electric light plant** at the corner of Montgomery and Mission streets, adjacent to the Palace Hotel, is just being completed and is to furnish the power for lighting the above mentioned hotel.

**Strenuous objections** are being raised by property owners along the proposed line of the elevated electric railway, an application for a franchise for which is now pending before the Board of Supervisors.

**G. Girandi,** of San Jose, who received a severe shock by coming in contact with a live wire belonging to the Electric Improvement Company of that city, and who brought suit to recover $11,000 damages, has been awarded $2,000.

**An electric railway** is to be constructed from Menlo Park to the Leland Stanford Junior University, and thence to the town of Mayfield. The Western Union has recently established a branch office at the great University.

**Articles of incorporation** of the Merchants' Electric Light Company, of Santa Rosa, have been filed. The capital stock of $50,000 is held by prominent business men. It is the intention of the new company to erect an electric light plant at once.

**Two propositions** have been submitted to the trustees of the city of Alameda to take from their hands the electric light plant, which has been given the sobriquet of "Alameda's White Elephant," and maintain same at a much less figure than it has cost the city.

**An electric light war** is now raging in this city, the principal parties concerned being the California Electric Light Company and the Electric Improvement Company. Since the rate war has been inaugurated users of the incandescent and arc lights have received a reduction of nearly 50 per cent.

**J. W. Hartzell,** general manager of the San Francisco and San Mateo electric road, has applied to the board of supervisors for a franchise to erect and operate an elevated electric road in certain streets of this city, and to have two miles of same in operation inside of 18 months, and the remainder within three years. Should the franchise be granted it will mark an important era in railroad travel, and tend to solve the vexed problem of rapid communication with the suburbs.

**A Few Months Ago** an ordinance was passed by the supervisors prohibiting the stringing of wires on house tops and demanding the removal of those already strung. Several small companies complied, but the larger ones did not, whereupon Chief Scannel, of the fire department, started out on a "cutting bee," but was temporarily enjoined by Judge Levy upon complaint of the Electric Improvement Company. This company claims that their wires have been molested, while those of the opposition company have not been interfered with. H. R. K.

San Francisco, February 18.

## OUR INDIANAPOLIS LETTER.

**Shelbyville, Ind.,** will soon have an electric road. The articles of incorporation were filed last week.

**The National Electric Headlight Company,** of this city, are doing a large business in their line of equipping engines with their headlight.

**The Central Thomson-Houston Electric Company,** have just installed an electric elevator at the VanCamp Hardware and Iron Company building.

**The Fort Wayne Electric Company** are installing a 750 light dynamo at Seymour, Ind. The work is in charge of Mr. F. W. Monroe, of Chicago.

**Mr. M. B. Austin,** of the Western Electric Company, of Chicago, was here and reports business very good in the supply trade. He is on his way through the South and West.

**Mr. C. P. Woodsworth,** general agent for the Central Thomson-Houston Electric Company, at Indianapolis, has made a number of sales the past week, both in and around the city.

**The Broad Ripple Street Railway** will probably be built, as the county commissioners have given the company until March 7 to file a certified check for $10,000, the same to be forfeited to the county if the road is not built.

**One of the Most Complete Plants** in the city is at the Indiana Bicycle Manufacturing Company. They have a Western Electric arc dynamo, also an incandescent dynamo and a Thomson-Houston electric welding apparatus. This is the largest factory of this kind in the West.

**The Central Thomson-Houston Electric Company,** of Cincinnati, have secured the contract for the installation of a 500 light dynamo at the Grand Hotel in this city. The Buckeye Engine Company will furnish the engine for running same and the work will soon be started.

**A New Device** in the way of a mast arm for arc lamps has been in use here for a short time. The invention is the work of Mr. Thos. Dillon, superintendent of the Brush Electric Light Company. When the arm is lowered the lamp is cut out and there is no danger of handling it, and when hoisted the lamp is cut in, thus doing away with all danger. VOLT.

Indianapolis, February 20.

## Press Club Dinner.

The annual dinner of the New York Press Club will be given at the Metropolitan Hotel, on the 27th inst., and from present indications promises to be one of the most successful ever given by the Club. Among those who have accepted invitations are: Mayor Matthews, of Boston; Mayor Stuart, of Philadephia; Speaker Bush, of the New York Assembly; Hon. Chauncey M. Depew, General Horace Porter and Col. Robert G. Ingersoll. These gentlemen may also be prevailed upon to make speeches on some very timely topics. Treasurer John C. Hennessy of the dinner committee has tickets on sale at the Club and reports that they are rapidly being taken up.

## American Institute of Electrical Engineers.

At the regular monthly meeting of the Council, held February 16, it was voted that the general meeting of the Institute for 1892 be held in Chicago. This meeting has heretofore been held the third week in May, but the exact date of the Chicago meeting has not yet been fixed upon.

## California Electrical Society.

At a meeting of the California Electrical Society, held at its rooms in San Francisco on Febuary 1, the following officers were elected for the ensuing year:

President, Geo. P. Low; vice-president, C. O. Poole; secretary, W. I. Crossett; treasurer, Orion Brooks; executive committee, E. A. Roe, C. T. Ryland, Jr., and R. B. Elder.

## Popular Lecture at the American Institute.

The electrical section of the American Institute is to be commended for the educational work it is doing in providing a series of popular free lectures on electrical subjects. These lectures occur the second Wednesday of each month, and are delivered by gentlemen thoroughly familiar with the subjects at issue. The meetings of the section are held at the rooms of the American Institute in the telephone building, 113 West Thirty-eighth street.

On Wednesday evening, February 17, Mr. E. T. Birdsall, president of the electrical section, read a paper entitled "Modern Practice in Central stations." A number of well selected lantern slides was used to illustrate the lecture which was heard by a good sized audience.

## PERSONAL.

Emil Berliner was at the Union Square Hotel, this city, recently.

Mr. John I. Beggs, of the Edison General Electric Company, Chicago, was in New York last week.

Mr. W. D. Packard, of the New York and Ohio Company, Warren, O., visited his New York friends recently.

Mr. T. W. Sprague, of the Thomson-Van Depoele Electric Mining Company, Boston, made a brief visit to New York last week.

Dr. Louis Bell, editor of the *Electrical World*, will resign his position on March 1 to take up the profession of electrical engineering. Mr. Carl Hering, a well-known writer on electrical topics, will succeed Dr. Bell in the editorial chair.

Mr. O. S. Hussey, who has been with the Thomson-Houston Electric Company for over two and one-half years, has severed his connection with that company to form a copartnership with E. W. Bailey, under the firm name of Bailey & Hussey, dealers in doors, windows, blinds, etc., Boston.

Mr. L. L. Phillips, of Seneca Falls, made his friends in this city a visit last week. Mr. Phillips is the president and proprietor of the electric railroad which runs between Seneca Falls and Waterloo, N. Y. He reports the road to be in first-class running order, and the best of all is the enterprise is a financial success.

Mr. S. J. Parmiter, of Cortland, N. Y., who makes a specialty of electric supplies, etc., visited this city recently. Mr. Parmiter is comfortably situated in the old town of Cortland, and is the representative man in his line in that vicinity. He seems to be enjoying the confidence of the community and satisfaction generally is depicted on his countenance.

Electricity guards many of the treasures of the Metropolitan Museum of Art in New York. In the room containing the Moses Lazarus collection of miniatures, painted porcelain and other rich and valuable objects of art, there are wires running underneath the lid of each case. If anybody tried to lift the cover or disturb it in any way, a bell would ring in General Di Cesnola's office, and also give warning on the ground floor by ringing a big gong. There is a similar arrangement in use with other valuable cases.

## Telephonic News

*** The Sunset Telephone and Telegraph Company, of Washington, will spend $160,000 on long distance telephone line extensions this year.

*** The Great Southern Telephone Company is seriously considering the idea of building a line from Vicksburg, Miss., to Lake Providence, La.

*** The annual report of the Central New York Telephone and Telegraph Company shows a very favorable state of affairs for that company. The growth in number of subscribers has been very satisfactory, and the relations of the company to the public which it serves are very cordial.

### Interior Conduit and Insulation Company's New Switch.

Electrical switches for breaking currents of both large and small capacities may be divided into two classes. 1. Those that are required for constant use. 2. Those that are but seldom called upon to perform the service for which they were designed. The key socket is a ready illustration of the former and the huge feeder switch of the latter class. To the first class many new designs are contributed from time to time, but to the latter, the use being to a certain degree limited, but few are well known enough to demand recognition. The device illustrated herewith is a switch of the second class, and it is known as the V. V. service cut-out, the invention of Mr. J. H. Van Vleck, the electrician and chief engineer of the Edison Electric Illuminating Company, of New York, for whose special requirements the switch was originally designed.

The fire underwriters in the principal cities require the placing of a switch and cut-out in the main line of every circuit entering a building which can be readily disconnected in case of necessity by the firemen, and when so disconnected insures that the current is absolutely shut off.

The above switch, combining in a contact, forms within itself a switch and cut-out, has filled this requirement to the entire satisfaction of the New York Edison and other well known illuminating companies.

In this device the extra cost of the switch arrangement is but a small additional expense over the necessary safety cut-out, so that the combination fills a gap between the conditions where the expense of a regular star snap switch and cut-out would be unwarranted, and where a cut-out without a switch would be incomplete.

The switch is constructed wholly of fireproof material, its base and cover being of the best quality of porcelain. It is made for the two and three wire systems on the plan illustrated, from which it will be seen that one-half of the device embodies the ordinary safety cut-out principle for holding the safety fuses, while in the other half there is a novel form of quick acting snap switch.

The connections are of bronze of ample capacity, with strong screws for the binding posts. The contacts, made by means of the plug, are admirably fitted, and when the plug is withdrawn to open the circuit the movement is accelerated by means of a strong spring which is contained in the plug itself, insuring a rapid and complete break with a sharp snap action. The only exposed portion of the plug is finished hard rubber, the whole presenting a neat and attractive appearance.

The use of this appliance is, however, by no means limited to the above particular purpose, but is offered by the Interior Conduit and Insulation Company, of New York, for general use in the belief that it is the best and cheapest three wire main line cut-out and switch for general wiring in the market.

### My Reminiscences of Lincoln.

READ BY MR. A. B. CHANDLER BEFORE THE NEW YORK ELECTRIC CLUB, FEBRUARY, 12, 1892.

I received, two or three days ago, with surprise—and I must also say, with regret—a copy of a circular issued by the entertainment committee of this club, which makes it proper and indeed necessary that I should tell you the facts, otherwise I may be charged with "sailing under false colors," and your committee may be suspected of having been misled. This circular makes it appear that I sustained such relations to President Lincoln as could hardly be attributed to his own private secretaries. I do not know how such an impression came to be entertained by your committee. Of course, I never claimed or stated anything of the sort; and, before proceeding to answer the demands incident to this occasion, I want to remove any mistaken notion that the circular may have caused as to the importance of my relations with Mr. Lincoln. I was not consulted as to the advisability of his issuing the Emancipation Proclamation, nor, in fact, as to the conduct of the war, or the administration of the civil government. The fact is, simply, that I was a telegraph boy, and by reason of the grace and confidence of then Major, and subsequently General, Eckert, who was superintendent of the military telegraph in the Department of the Potomac, and with whom I had been acquainted for some years previously, it fell to my lot to be associated with others, more especially with Mr. Tinker and Mr. Bates, in carrying on the cipher correspondence of the military telegraph office in the War Department during the great war of the Rebellion

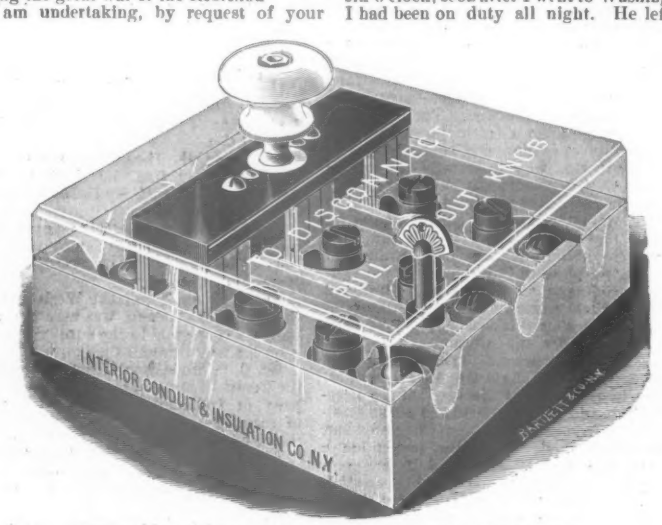
I am undertaking, by request of your committee, to tell you something of Abraham Lincoln. I consented to do so, with reluctance, for two reasons: First, because the demands upon my time and attention are so constant and exacting that I knew I could not make such preparation as the subject merits; and, second, because I was but just past my boyhood when it was my privilege to see that true nobleman almost every day, and while much that I saw of him, and much that I heard him say, was of great interest to me at the time, I was too constantly occupied with pressing and important work in the service of the United States military telegraph to permit the making of such notes as I otherwise would have made, and the flight of time, with its ever changing scenes, and its, for me, almost ceaseless duties, has so far obscured my memory that I now find that many of the notes which I did make have lost much of their value, because I left too much to be supplied by memory. I was, therefore, apprehensive that I should not be able to interest you in such measure as you have a right to anticipate, in view of the almost universal admiration in which Mr. Lincoln is now so justly held, and the opportunities which I had of becoming acquainted with his ways and his manners, his surroundings, his besetments and his actions.

You have all read much about Lincoln; of his tall and gaunt frame, his awkward, almost uncouth, manners; and his face and figure are as familiar to you as excellent pictures and admirable sculpture can make them. The several biographies and the numerous "reminiscences," written by public men of his time, and by others who were among his intimate personal friends, and especially the history written by his private secretaries, Nicolay and Hay, together with the great number of eulogies written and spoken concerning him, and the stories told of him and attributed to him, seem to leave little room for the saying of anything new about the great and good man who was born 83 years ago this day, in the midst of such poverty, not only of purse, but such poverty of surroundings, in every particular, that his natural gifts of mind and heart, and his wonderful development, astonish us anew whenever we contemplate them.

But I shall not undertake even the briefest relation of his history, nor shall I, at this time, eulogize his goodness, or his greatness, otherwise than to acknowledge them and to express my gratitude for his noble and superlatively useful life. My present remarks will be limited to a few, only, of my own recollections of him, and I perhaps ought to say at the outset, that none of them are of any special importance to anybody but myself, except in the fact that they relate to him.

I first saw Lincoln at Allegheny, Pa., when he was on his way to Washington to assume the task of reconciling a great nation to itself; for it was even then clear that his administration was to be fraught with difficulties such as had not fallen upon any previous President of the United States, although I believe that neither he nor any other citizen of the Republic had then any expectation that so terrible and destructive a war was impending. He was received there with great enthusiasm by the multitude that had gathered to see him, and acknowledged their demonstrations with the homely dignity that was peculiar to him, and without making any speech. I was among the few who were there privileged to enter the private car in which he and his family were making their journey, and I shall never forget the deep impression which his towering form and his already sad, and always kindly, face made on me as I took his hand. I had then no expectation of seeing him again during his Presidency.

The next time I remember of his speaking to me was very early one morning, perhaps six o'clock, soon after I went to Washington. I had been on duty all night. He left the




INTERIOR CONDUIT & INSULATION COMPANY'S NEW SWITCH.

office as late as 10 or 11 o'clock the night before, but so anxious was he for news from the armies that he often came over from the White House soon after daylight to see the dispatches which had come in during the night. He happened to find me on this morning in just the same position (writing at the desk that we then called Col. Stager's) in which he had seen me the night before, and, as he came in, he said, "Have you been sitting right there all night?" Then he read over the new messages, carbon copies of which we made on letter size tissue paper and put, without folding, in a little drawer in what we called the cipher desk. The contents of this drawer were for his special information. The messages were placed in it in the order of their reception, and he was quite careful to keep them so. It was his habit to read them from the top down, and when he came to those which he had already read, with a smile, he said, "Well, I guess I have got down to the raisins." As I seemed in doubt as to what that might mean he explained that a little girl, having eaten improperly, both in quantity and quality, beginning with a lot of raisins, was made quite ill, and could only find relief in the process a sick stomach is apt to compel. After an exhausting siege of throwing up, she gave an exclamation of satisfaction that the end of her trouble was near, for she had "got down to the raisins." I suppose that I have heard Mr. Lincoln use the expression 20 times, at least, when he had finished reading the new messages in his drawer, and had reached those which he had read before.

One day, soon after this, hearing a newsboy on Pennsylvania avenue, in front of the War Department, calling out in a sing song way, "Here's yer Philadelphia *Inquirer*," he mimicked him, and then said, "Did I ever tell you the joke the Chicago newsboys had on me?" Receiving a negative reply, he said, "A short time before my nomination I was at Chicago attending a lawsuit. A photographer of that city asked me to sit for a picture, and I did so. This coarse, rough hair of mine was in a particularly bad tousle, and the picture presented me in all its fright. After my nomination, this being about the only picture of me there was, copies were struck to show those who had never seen me how I looked. The newsboys carried them around to sell, and had for their cry, 'Here's yer Old Abe, 'll look better when he gets his hair combed.'" And he laughed over it as heartily as if it was a good joke on somebody else that had just occurred.

I told this story to a gentleman whom I met not long after in a railway train, and the next issue of *Harper's Magazine*, I think it was, contained it, relating the circumstances under which I told it. This is one of the several Lincoln stories which I furnished for the History of the Military Telegraph, and respecting this one, the author of the work added a note saying he had seen it substantially published elsewhere. The explanation I have just made will, I think, account for its previous publication. I shall endeavor not to repeat here any other stories or incidents that were printed therein, nor any that I have told or referred to on previous public occasions.

One Summer's night Mentor's band, from Cincinnati, serenaded the President at the White House, which was so near the War Department that I heard and greatly enjoyed the excellent music from my open window. Shortly after it was over, Mr. Lincoln came in, as usual, to learn the day's happenings, as reported by telegraph. He referred to the music he had just been favored with, and said serenades were very hard to answer. He could make a speech generally easily enough, but it was hard to apply a speech to a serenade; and that form of expression reminded him of an old doctor who, in criticising the craze for the use of steam as a cure-all, said that, "steam did very well in medical practice generally, but it was hard to apply it to a broken gut."

A friend of mine in New York wrote me asking for a good picture of Mr. Lincoln, with his autograph upon it. So I bought a couple of good photographs of him, and when he came in that evening I asked him to put his name on them, remarking that I supposed he was frequently annoyed by similar applications, but I would much like to please my New York friend. He said, "Well, I suppose you know that men will stand a good deal when they are flattered a little." I smiled doubtfully, and he continued, without waiting for me to reply, "You haven't learned that yet? Well, you needn't remain any longer in ignorance of it, because it's so." I told him I would remember it, and thanked him for the autograph, which he had finished while talking to me.

It may interest you to know that he was much in the habit of sitting with his feet on a table or desk or chair. In cold weather, during all my observation of him, he wore a large gray shawl and never an overcoat. This shawl he usually hung over the top of the inner door of the office as he came in, a position in which a man of ordinary height could not place it. You may like to know, as probably most of you do not, that his composition, in writing, was slow, and apparently somewhat labored, and his writing itself was a comparatively slow process. While writing, as I have often seen him, sitting directly opposite me and at the same table, he was accustomed to look out of the window, scratch his head, usually his right temple, form his sentences in his mind, often moving his lips in actual whisper of the words, and then write them out, rarely erasing, interlining or correcting, and when he had finished, what simple and perfect diction it was. His style of composition was as peculiar and unique as himself, and always in simple, terse, and clear language. He sometimes read aloud, and in doing so would occasionally purposely mispronounce words, and misplace inflection and accent, as if musing as he read. His keen sense of the ridiculous extended to very little things and he was as perfect a mimic as his very large frame would permit. One of the best examples of this that I remember was this: Mr. Albert Johnson, Mr. Stanton's private secretary and personal accountant, was, and still is, bless his kind heart, a man of unusually small stature, weighing, perhaps, a hundred pounds, and his deportment was extremely polite. On one occasion, Mr. Lincoln wanted to refer to the Bible, or a dictionary, I really don't remember which, and he asked Johnson to bring it. Johnson danced out of the room to get it, but not finding it quickly, and fearing the President might become impatient, he ran back to explain that he had not found it yet, but would have it presently, and finally brought it, with an apology for the delay, and, with very low and repeated bows, retired. After Mr. Lincoln had made the desired use of the book, he ran into the adjoining room just as Johnson had done, reappeared with the same bows and explanations, and then made his delivery of the book in the same fashion, greatly to his own and our amusement. This may not strike anybody as funny, but the extreme contrast in the size and move-

ments of the two men, and the close imitation of the mimicry, made it appear decidedly so to us, for whose benefit he performed the bit of acting.

He came to our office, as he said, "to get rid of his persecutors," most of whom wanted to see him "just a minute," which meant that if he could hear their whole case, and decide just as they wanted him to, in a minute, then that was all the time they wanted, but that it did not often happen so.

Peculiar names and alliterations seem to have had a charm for him, and he would repeat them over and over to himself. He was in the habit of talking to himself, as I several times observed when he was walking between the White House and the Department. He was very fond of his little boy "Tad," who was often with him, and whose idea of the good faith of the cipher operators, I suspect, was derived from his father. It was, at any rate, well illustrated in this: I was one morning passing the White House. As I entered the great "porte cochere," on the north side, I saw Tad playing in an express wagon that was standing there. Although eight years old or so, he could not talk plainly, much of his speech being quite unintelligible to any one not accustomed to it. He recognized me at once, and called out "What de new?" I answered, "Nothing new this morning, Tad." He said quickly, "Oh, I know bet', there i' and you won't te'."

The battle of Drainesville was, I believe, the first engagement of the army of the Potomac under McClellan, and occurred after weeks of spirited picket firing. It, however, accomplished nothing in practical results, and it seemed that both armies were afraid to make a serious attack. After reading the reports, Mr. Lincoln said it reminded him of two puppy dogs he had seen barking furiously at each other through a paling fence. They kept up the most savage snarling as they ran along, until they came to an open gate, when each snapped his jaws at the other, turned quickly around and ran away.

The first news of the battle of Drainesville was to the effect that our forces had whipped the rebels, and captured 50 Colt's revolvers. Mr. Lincoln read the message aloud, and asked the little boy who had handed it to him if he could tell how soon those Colt's revolvers would grow to be horse pistols.

One morning, after Gen. Grierson's celebrated raid, Mr. Lincoln came in, and, as the raid was the most important recent military event, it was made the subject of conversation. Mr. Lincoln remarked that it was a most extraordinary movement. Grierson started into the rebel lines at Memphis, and nothing was heard of him for nearly three weeks, when he arrived safely at Baton Rouge, with his command, having done serious damage to the Confederate railroads, machine shops, mills, etc., along his route. The President said it reminded him of a story he once heard, of a person who had run a needle into his hand, and never knew anything of it again till it came out of one of his feet, 15 years afterwards.

One day, on opening a letter from a surgeon in the army, he found it to contain the doctor's photograph, and it was evidently designed to make a good impression on the President. He was a large, fine looking man, but chiefly remarkable for the great length of his hair and whiskers. He showed the picture to me, and said he presumed the doctor was a very clever fellow, though plainly rather proud of his imposing appearance. He rather thought, he said, that if he had two such, male and female, he should like to raise 'em for the hair.

When he finished reading the telegrams announcing the result of Sheridan's last fight with Early in the Shenandoah Valley, he said he thought Early's army was in about the same condition as a dog he once heard a man say he had killed. The hateful cur ran fiercely at him, snapping at his heels and annoying him provokingly every time he passed his owner's house, and he determined to be rid of him. So he one day filled a piece of punk with powder, set it on fire as he was about to pass his neighbor's house, clapped it inside a biscuit, and when the dog rushed at him as usual, tossed the biscuit to him. In an instant the dog snapped it up and swallowed it. Presently the fire touched the powder, and away went the dog—his head in one place, a leg here and another there, and the different parts of him scattered about. "But," said the man, "as for the dog, *as* a dog, I was never able to find him." After this last fight, Early's army, *as* an army, the President said he thought it would be very hard to find.

Among the notations in my journal for the 23d of June, 1864, I find the following: "Mr. Lincoln returned from the army today, and this evening told me many things; of his reviewing the troops, etc. I suppose he would have talked just the same if it had been any other boy showing him the despatches, but it happened to be me. I feel relieved, knowing he has just come from General Grant, and is feeling in so cheerful mood." That's the quotation from my journal, and yet I did not write a word of what he said on that occasion, and I have vainly tried to recall it. It has wholly gone from my memory. How could I have been so stupid? And this is a good illustration of many others of my notes. You may all accept this as a warning that, unless you are gifted with a much better memory than mine, you must be careful to make full and explicit notes of whatever you may wish to retain for future use or reference, or you will be likely to lose much of it in a very few years.

Of one thing I wish to make special and grateful mention, namely, the deep and genuine sympathy which Mr. Lincoln manifested for the soldiers in the field. He did not fail to realize the necessity for the exercise of strict discipline, and yet no soldier boy was ever executed for sleeping on his post, or other like offience, when Lincoln could prevent it. I think I have known him to come over to our office, himself, alone, at least half a dozen times in the night, with a message of reprieve for some poor fellow who was under sentence of death, which nothing but the President's power could stay, and his solicitude would not allow him to intrust his message to an "orderly" or other messenger when a human life depended upon his direct action, and an execution might take place unless the official stay was hurried to its destination.

PART II.

Your committee informed me that they would like my remarks of this evening to be comprised in two parts, so that music might be interspersed for your entertainment. It struck me that this was an exceedingly good idea. I have listened many a time with forced respect to a tedious and pointless discourse, when I would have given my last year's boots to have stopped the speaker, at least long enough to have listened to a song, or even a waltz. And I hope you are all sufficiently refreshed by the excellent music with which we have just been favored, to listen patiently for a few minutes to something which I have taken the liberty to avail myself of this opportunity to say, and which relates only in part to Mr. Lincoln. What I have now to say relates chiefly to Edwin M. Stanton, the great war minister, whose name and fame is inseparably connected with that of Lincoln, and yet it seems to me scarcely less than great injustice and ingratitude that his name, and his face and figure, are not more prominently before the American people in these later days than they are.

I feel sure that it is not too much to say that no one person, other than Mr. Lincoln and General Grant, is entitled to more credit for the successful conduct of the great civil war between the North and the South, and the preservation of this great country as a united, prosperous and invincible nation, than Mr. Stanton. His energy was tremendous. His zeal and his industry were pre-eminent to the last degree. His patriotism was of the very highest order, and his ability in the performance of the particular duties that devolved upon him as an organizer of war was, it seems to me, beyond all question, greater than that of any other man to whom such heavy burdens, of such transcendent importance, could have been assigned.

Stanton was the very antithesis of Lincoln, in stature, physique and personal appearance; in his habit of thought and his mode of action. As I have said, Lincoln wrote slowly and accurately, leaving little room for revision. Stanton dashed off his thoughts as swiftly as his strong hand could move his pen across the paper, and then he cut and slashed, reviewed and revised, until the matter in hand was finished to his satisfaction. If it came to his knowledge that any man was suspected, even, of disloyalty, or of action tending to interfere with the administration of the government by those to whom it was intrusted, it did not suit him to wait for positive evidence, nor to consider with extreme care what injury might be done to the individual by the exercise of severe measures. His tendency was to first remove, as far as it was possible, any *chance* of injurious result from the action of the suspected person, and trust to the future to set the individual right, rather than to run any *risk* of harm to the government. Lincoln's tendency was to believe every man was right, or at least acted from right motives, unless evidence to the contrary was clear and unmistakable. Mr. Stanton was terribly in earnest. He appreciated the full measure of peril by which the government was surrounded, and the nation's life was dearer to him than any other consideration. He had no patience with Lincoln's lively, yet unseasonable interest in, and reading of, the keen and satirical humor of Petroleum Nasby's Letters from the Confederate Cross Roads. He had no patience with Lincoln's narration of trivial stories on occasions and in the midst of conferences involving the safety of the nation. In July, 1864, when Washington city was seriously threatened by a large rebel force, Mr. Lincoln made, one day, a tour of observation to the fortifications to the north and west of the city. While engaged in this, he witnessed quite a spirited affray between a small detachment of rebels and Union soldiers. I have in my possession the diagram which he made in the telegraph office immediately after his return to the city, showing the position of the different forts, and where and how the skirmish took place, which he noted for the information of three or four of us who were intensely interested in learning the situation and, as far as we could, the extent of danger to the city. Even under these circumstances, the inevitable story came to his relief, and he told us of a couple of new inventions of which he had lately heard, one of which was designed to prevent hens from scratching up the garden, and which consisted of a movable brace, attached to the hen's legs, and which at each scratch moved the hen forward and, by successive scratches, out of the garden, and which was designated "The Hen Walker." The other was a little trap-door, adjusted under the hen's nest, which, on the appearance of the egg, let it fall out of the hen's sight and reach, the effect of which was said to be that the hen would immediately set about laying another egg; and this, much to his amusement, was called "The double patent back-action hen persuader." For all stories of this sort, and especially under such circumstances, Mr. Stanton on several occasions within my observation manifested scarcely less than disgust. Yet, we all know, and the magnificent record of the achievements of both men prove it, that neither was outdone by the other in the intensity of his loyalty and devotion to the best interests of the country.

I remember, on one occasion, hearing Mr. Lincoln address Mr. Stanton, with great gravity and a low bow, as Mr. Stanton came into the room, "Good evening, Mars," to which Mr. Stanton responded, without the least recognition of his facetiousness, "Good evening, Mr. President." With all his austerity and seriousness, Mr. Stanton was an exceedingly kind and companionable man, devoted to his family and his friends, as well as to his country, and I am sure that the President had the utmost respect for his ability and the utmost confidence in his judgment and the excellence of his purpose, although I think it is not to be denied that he was sometimes annoyed by Mr. Stanton's brusqueness and, we may perhaps say, his want of tact. On the other hand, while Mr. Stanton was sometimes greatly annoyed by the freedom with which Mr. Lincoln gave out information concerning the status of affairs, at what he considered inopportune and improper times, so much so, in fact, that he sometimes gave strict orders that no telegrams other than those addressed to the President direct should be allowed to be seen by him until they had first been seen by himself; and while, as I have said, he regarded his story-telling as undignified, and often out of place, I think there can be no question but that he also regarded Mr. Lincoln as pre eminently the man, of all men, best fitted to occupy the position which he did occupy; and of all his cabinet, I believe there was none more loyal to him, as well as to the country, than was Mr. Stanton. The great war secretary literally wore out his life in the services of his country. He accomplished a work which I believe no other man then living could have accomplished in his place, and I trust the day will yet come when his services will be recognized—as it seems to me they never have been—and when, throughout this broad, prosperous and glorious land, the name of Stanton, as well as the name of Lincoln, shall be honored and revered by every intelligent freeman in all our vast domain.

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After Mr. Chandler had finished reading his address, Mr. Jarvis B. Edson, introduced President Holloway, of the Engineers' Club. Mr. Holloway was present at the convention in Chicago which nominated Abraham Lincoln for president. He described the scene on the convention floor when the delegations from the various States gradually came around to casting their votes for Lincoln. The vote was unanimous, except for the New York delegation. Then, amidst clamor and shouts, Senator Evarts made his way to the platform and announced that the New York delegation was solid for Lincoln. Mr. Holloway said that he had also seen Mr. Lincoln after this near Pittsburgh, a short time previous to the first meeting between Lincoln and Mr. Chandler.

Gen. James R. O'Beirne, assistant United States Commissioner of Immigration, was also present at this meeting of the Club, and followed Mr. Holloway with some very interesting personal anecdotes of Lincoln. General O'Beirne was provost marshal of Washington at the time Lincoln was assassinated. He described how he heard the news that the President was shot, while sitting in a hotel chatting with a friend. He immediately jumped into his buggy, which was standing outside the hotel, and drove as quickly as he could to the house across the street from the theatre where Mr. Lincoln was shot. Here he found an immense crowd collected and with difficulty made his way to the door. He found Secretary of War Stanton in charge and was immediately dispatched by him to the Secretary of State's house. On arriving there he found that Mr. Seward had also been seriously wounded by an assassin and was unable to return with him. General O'Beirne then went back to the house where the president lay and established a guard about the house. General O'Beirne described minutely the circumstances and incidents preceding the death of the President and drew a powerful picture in words of the grief of the President's wife, occasioned by the sad calamity which had befallen her. General O'Beirne also paid a high tribute to Secretary of War Stanton, into whose hands the management of affairs temporarily fell.

## TELEGRAPHIC

.... The Chicago and Northwestern road is being equipped with electric signals.

.... The Canadian government is strongly considering taking over and operating all the telegraph lines of the Dominion.

.... The annual report of the American District Telegraph Company for 1891, shows gross earnings, $502,769; expenses, repairs and construction, $471,424; net earnings, $31,348; miscellaneous income, $13,938; total, net, $45,287. Dividends paid, $51,000; capital stock, $3,000,000, of which $450,000 is in the treasury. The capital stock was increased to $4,000,000, with which to purchase the stock of the Mutual District Messenger Company.

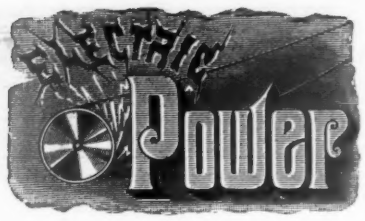
### Cutter's Lamp-Supporting Pulley.

It is now generally admitted that the best pulley for hanging arc lamps should hold the lamp when raised and automatically release it again when it is about to be lowered. For this purpose various combinations of hooks, springs and cams have been proposed; but George Cutter designed a pulley which accomplishes the same object without any of these hay-fork attachments. His lamp-supporting pulley has been in steady

CUTTER'S LAMP-SUPPORTING PULLEY.

use for nine months in all parts of the country, and this extensive practice has led to a number of improvements. These include the new swivel clamp shown in our cut, which allows the pulley to swing freely when engaging the special knob. The cut shows how this knob, which is rigidly fastened to the lamp, rests on the guides, which are made extra strong. The clamp fits all ordinary sizes of iron wire or stranded cable, and is quickly fastened in place. Sash-cord, manilla or wire ropes up to one-half inch can be used equally well with this pulley, and the lamp-supporting feature greatly reduces the wear on this hoisting rope.

The new form is well made, neating finished and thoroughly sleet-proof. It is already in use in a score of places and is giving the satisfaction which its simple and ingenious design would suggest.




* * Methuen, Mass., wants an electric railway.

* * An electric street railway from Harleysville, Pa., to Lansdale is being earnestly discussed.

* * The new electric railroad between Newark and Orange, N. J., was put in operation on the 1st inst.

* * Henry C. Tudor and Frank Fisher have been appointed receivers for the Waterhouse Electric Company, of Baltimore, Md., on the application of the Brush Electric Company.

* * A company has been formed, it is stated, to control a water-fall of 2,000 horse-power, at Marseilles, Ill., 80 miles from Chicago, with a view of transmitting electric power to that city.

* * Manager W. A. Whittlesey, of the Stanley Electric Manufacturing Company, of Pittsfield, Mass., states that their proposed new plant will be constructed so as to be able to manufacture power generators from 500 to 5,000 horse-power.

## Bunnell's Adjustable Extension Sounder Support and Resonator.

In the Decennial Number of the ELECTRICAL REVIEW, published February 20, there was printed a very interesting article on "Telegraphic Shorthand," by Mr. John P. Gavit, a practical newspaper man. The use of the typewriter in receiving telegraphic news dispatches was there outlined. A recent improvement in this line is illustrated herewith.

This device is designed for the convenience of receiving operators using typewriters for railway telegraph offices, where the noise of trains interferes with accurate receiving, for offices located in exchange board rooms, and for all offices where especially loud and distinct strokes of the sounder are needed.

The sounder is brought to any position required close to the receiving operator, and the entire volume of sound so greatly increased that it can be easily and distinctly heard over outside noise. Adjusting the position of the resonator also makes it possible to receive easily from an instrument which may be so closely adjusted that it cannot be heard by any one except the operator who is taking it.

The sounder, which is the famous Bunnell pattern, known as the Giant sounder, is clamped within a very resonant box which is open at both ends, and is sustained in mid-air by a swivel pendant on a swinging arm. This arm is also adjustable to be raised to, or lowered from, any height within the necessary range, and as the arm also swings laterally on its support, the operator can have the sounder wherever it is wanted.

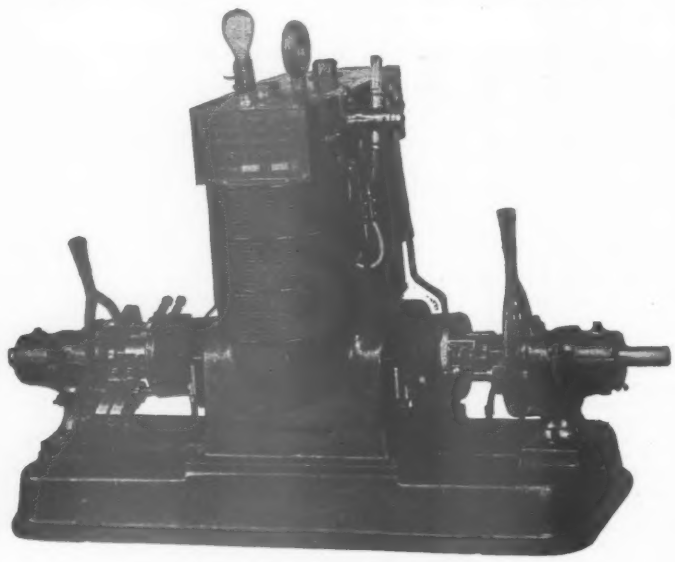
The effect of clamping the sounder within this peculiar resonating box is to increase its loudness and distinctness to a startling extent, leaving nothing more to be desired in that direction unless the operator is nearly stone deaf, for the instrument, with its enormously increased sound, can be brought so close as to almost touch the ear if desired. Under these circumstances, no typewriting machine, however noisily it may click or clatter, can interefere in the least with receiving by sound.

In railway telegraphy, at noisy stations, in stock exchange telegraph offices, and in every possible situation where the telegraph must be operated in the midst of the roar and crash of such forms of modern daily business as are inseparable from noise, this device will be a welcome facility and will add to the accuracy of the work done.

The typewriter for receiving, instead of pen and pencil, has been extensively adopted during the past two or three years, and its use has been attended with some difficulty owing to a tendency to confuse the receiver, caused by the click of the machine being sometimes as loud as those of the sounder. This interference being entirely eliminated will, doubtless, bring typewriter receiving into still more general use.

## New Edison Transformer.

In the present condition of electrical science and practical progress, each succeeding week is marked by the advent of new appliances destined to attain some advantageous end, *i. e.*, the economizing of time and expense, or the subjection of electricity to new and hitherto unconceived uses. This week we have to chronicle the genesis of a new Edison continuous current transformer, or motor-generator, of especial interest to practical electrical men on account of the novel features which it presents. This machine has been designed for special use on street railway circuits, and is employed to convert the current from 500 volts on the motor to 125 volts on the dynamo, thus furnishing a current of low tension for either lighting or power.



NEW EDISON MOTOR-GENERATOR.

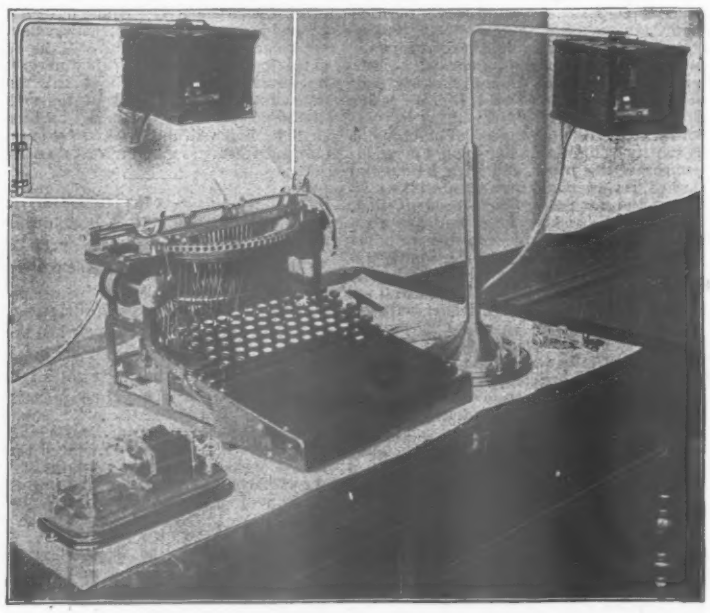
The motor-generator is, in reality, a combination of two machines in one. As its name implies it is both a motor and a generator. The armature is so wound that it has two distinct windings, and each end is furnished with its commutator, rocker arm and brush holders. The cut shows the appearance and arrangement of one of these transformers, that of six kilowatt capacity. The dimensions are those of the standard Edison 12 kilowatt generator, with the exception of the length of the bed-plate and pole pieces. The head-board at the motor end of the machine is provided with a double pole switch, that at the generator end being furnished with a single pole switch.

The great advantages which such a machine as this presents, can hardly be estimated from a mere cursory examination. Its economical mission is that which will most strongly appeal to users of electric light and power. For instance, lighting is to be accomplished at a distance from the source of power, as is the case in hilly districts. Here a turbine and generator, evolving current of high potentiality can be placed near a waterfall, to supply electricity to lamps in premises some miles away. In the place of a receiving motor for the high potential current belted to a separate generator, one of these transformers can be employed to take the place of the two machines, and the saving effected is obvious.

Another instance may be given. A street railway station, in which the machines are generating current at 500 volts, finds it possible to utilize a portion of this current for incandescent lighting purposes. Instead of a subsidiary motor belted to a dynamo wound for 125 volts, or a separate engine and generator, wires are led from the 500 volt machine to the motor generator, and current of the necessary tension for incandescent lamps is produced.

The uses of these machines, however, are not confined to the conversion of high potential current to low tension current alone; the converse also holds good, low tension current can be supplied to it, and high tension current developed, proportions always holding. They are manufactured in various sizes and for various voltages, the highest being as high as 1,200 volts in primary circuit at the Schenectady Works of the Edison General Electric Company.

The "Notes and Comments" announced to appear in the March number of the *North American Review* will include some unpublished letters by Henry Clay, favoring the nationalization of the telegraph; and an article by Dr. Walter F. Chappell, showing to how great an extent the presence of consumptive patients at health resorts imperils such places. The Mexican Minister writes on Wages and Values in Mexico, and Dr. Felix Oswald on the Frost Cure.



BUNNELL'S ADJUSTABLE EXTENSION SOUNDER SUPPORT AND RESONATOR.

## Edison Elevator Controller.

The Edison General Electric Company have recently designed and put on the market a new controlling rheostat for use with electric motors running elevators, hoists, and in other places where the conditions require that the motor be started, stopped and reversed continually. The controller consists of a resistance box of special form, as shown in the accompanying illustration. By the movement of a lever, resistance can be gradually thrown in or out of the motor circuit as required, thus increasing or diminishing the speed of the motor. The lever also carries the contacts required for reversing the motor. This controller can be employed with either shunt or series wound motors, and possesses the great advantage of an arrangement whereby, before the motor can be reversed, the whole resistance is thrown into the armature circuit. By this means the possibility of burning out the armature by too sudden reversal of the motor is prevented, and fluctuations in the voltage of the line wires, by too swift an accession of power, reduced to a minimum. The controller is constructed to carry continuous currents of 15 amperes with all the resistance in circuit, but currents up to 60 amperes can be passed through it, without injury, for a short time, when starting the motor. The contact lever can be worked by a handle or a pulley wheel, as conditions require. For elevator work, it is fitted with a pulley, around which passes the steel rope which, in the hands of the elevator man, controls the movement of the elevator.

The resistance consists of a continuous series of sheet iron convolutions, with mica insulation between the convolutions, divided into sections, each of which is connected to a vertical brass bar arranged around the iron convolutions, so that a special contact shoe on the lever arm makes a perfect frictional and flexible contact with the brass bars. The lever operating this contact shoe works over a slate table fitted with brass rings for the main and armature connections. Carbon contacts are used on these rings. As iron, brass and mica are the principal materials used in the construction of the controller, it is able to withstand a very high degree of heat, without risk of destruction. A space two feet two inches square and one foot ten inches high is required for the controller.

EDISON ELEVATOR CONTROLLER.

This controller takes the place of the older motor rheostat, and its novelty of form and the many advantages which it offers, should bring it into considerable requisition in places where the older and more cumbersome styles have hitherto been used, and should make it essential to all new installations of electric elevators or hoists.

Judge Johnson quashed the writ of *certiorari* recently issued in favor of the Milwaukee Power and Lighting Company, restraining the city from making a contract with the Badger Illuminating Company. The contract with the latter company was signed on the 4th inst., and goes into effect now for the next four years.

A trust deed was given by the Georgia Electric Light Company to the Southern Banking and Trust Company, of Atlanta, Ga., to secure its first mortgage bonds. A trust deed was also given by the Edison Electric Illuminating Company, of Atlanta, Ga., to the same banking house to enable the company to float first mortgage bonds amounting to $50,000.

### Electric Signals to be Used on the Northwestern Road.

The largest contract ever closed by a railroad company at one time for automatic electric signals was entered into by the Chicago and Northwestern recently. The road has also ordered 52 of the Hall automatic street crossing bells. The increase in accidents from collisions and open switches, owing to the necessity for higher running speed, has led the Northwestern to look for a system of signals to make the time all Chicago roads will have their suburban lines covered with the electric systems.

President Hughitt, General Manager Whitman, and Assistant Engineer Carter, of the Northwestern, went East three weeks ago to investigate the various signal systems. They decided on the Hall automatic electric block system as the one suited to the company's needs. The Northwestern suburban traffic is already enormous, and it is expected that the World's Fair will increase it at least one-half. This will necessitate the putting on of more trains, and the old system of keeping track of the trains by signals worked by telegraph operators, the officials think, will

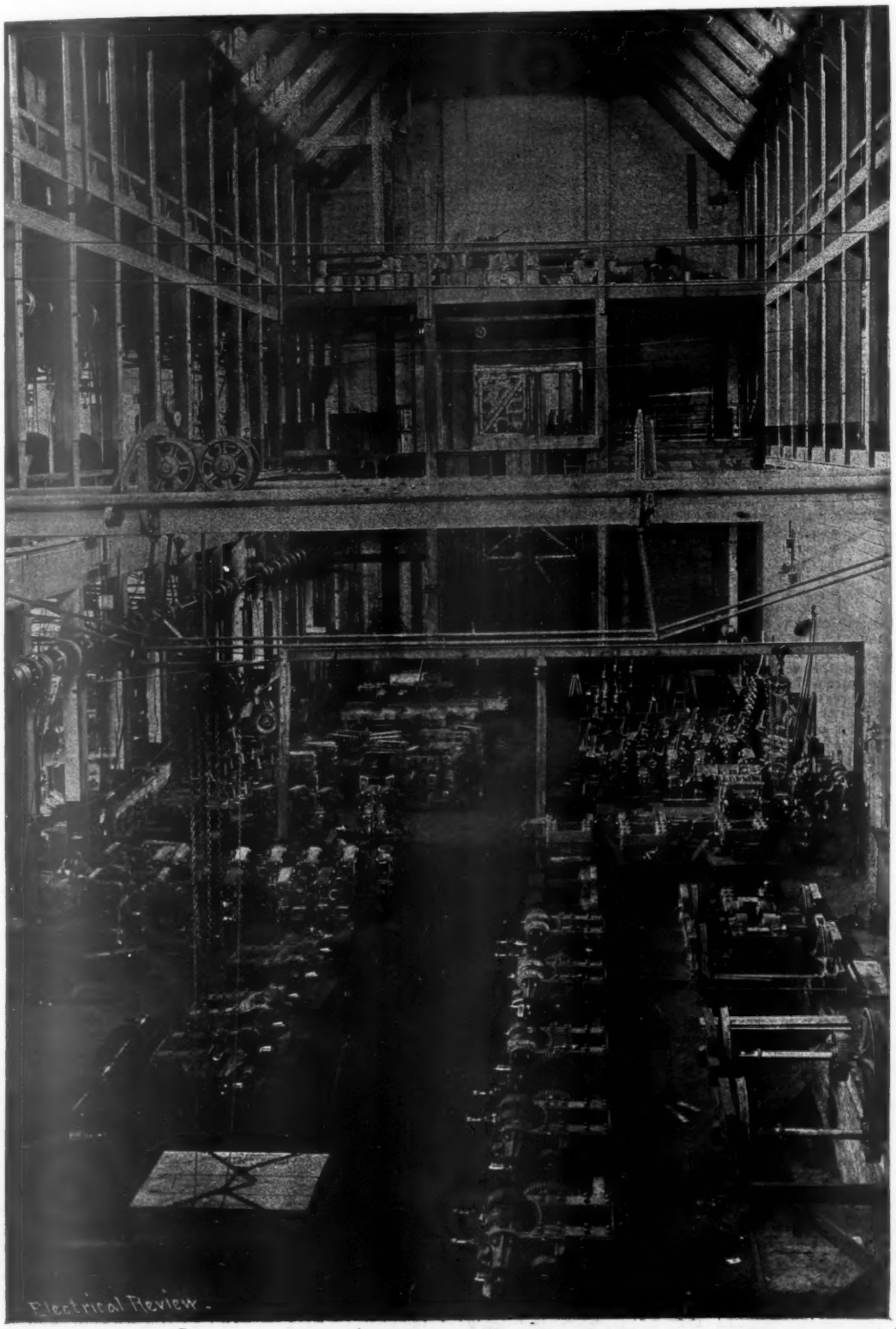



FIG. 4.—INTERIOR OF CATHEDRAL BUILDING, BRUSH ELECTRIC COMPANY, CLEVELAND.—(See first page.)

lines into the city from the suburbs safer.

It was not surprising that without an adequate system of protection collisions were frequent. Suburban train crowded on suburban train, and through trains crowded on these. Every day the danger was increased. Accidents have resulted in loss of life, destruction of valuable property, and great delay to traffic. It is to prevent all this that the Northwestern has taken steps. The movement has been caught up by the Chicago, Burlington and Quincy and Northern Pacific roads, it may be that in a short be inadequate. The automatic electric signals will be put on the different divisions, as follows: Galena division, from Fortieth street to Turner Junction; Milwaukee division, from Clybourn Junction to Waukegan; Wisconsin division, from Clybourn Junction to Barrington. Eighty-seven and one-half miles will be covered and 200 signals will be used, placed on an average of three-fourths of a mile apart; 188 switches will be protected.

The block system is operated as follows: On the outside of the rail a lever rises to the height of two inches. When the wheels of the train pass over this the lever is pressed down so as to open the circuit of an electric block ahead is clear. Among the railroads using the system, the electricity, it is claimed, has never been known to fail in doing its work. By a similar system of opening and closing of electric circuit trains are warned in case a switch is open in the block ahead.

The new bell system which the Northwestern will use to protect its grade crossings is modeled after the block system. At some distance from each street is a lever which the train presses in passing. This closes an electric circuit and a bell in the watchman's house begins ringing so loudly as to awaken the sleepiest occupant. The warning means that he is to shut the gates to all street traffic until the train has passed by.

## ELECTRIC LIGHT NEWS

—— Hanover, Pa., is talking a municipal lighting plant.

—— The Petaluma, Cal., Electric Light Company has determined to largely increase the size of its plant.

—— It is stated that Nottingham, Eng., is to establish a municipal electric lighting plant to cost $150,000.

—— The Harrisburg and Excelsior Electric Lighting Companies, of Harrisburg, Pa., have been consolidated.

—— The City Illuminating Company, of Murfreesboro, Tenn., has sold out to A. W. Kissam, of New York.

—— A committee of Elyria, Colo., Mayor Ward, chairman, has been appointed to investigate electric street lighting.

—— Dubuque, Ia., has contracted with the Edison Company, for street lighting for three years, at $64 per lamp per year.

—— The directors of the Casino Company, at Steuben, N.Y., talk of putting in an incandescent electric light plant for their play house.

—— The issue of bonds to raise money to purchase an electric street lighting plant was favorably acted upon at Schuyler, Neb., recently.

—— The Northwest Thomson-Houston Company, of St. Paul, has declared a quarterly dividend of two per cent. on the common stock.

The Western Union Telegraph Company has reduced its charges for messages from Evansville to all points in Ohio to 10 cents for 10 words.

—— The committee of Marblehead, Mass., chosen to consider the advisability of establishing a town electric lighting plant has reported favorably.

—— The Boston Electric Light Company will rebuild the Ferdinand street station at once, and expect to have it running again in about a month.

—— The Committee on Light of Manchester, Va., J. R. Perdue, chairman, has been authorized to contract for lighting the city by electricity.

—— The Milwaukee Electric Light Company, also known as the Milwaukee Telegraph Company, has been absorbed by the Villard Syndicate.

—— The contract for furnishing electric lighting to the City of Richmond, Va., was awarded on the 6th inst., to the Richmond Railway and Electric Company.

—— Collector Hebing, of Rochester, N. Y., has made application to the government to have an electric light plant put in the government building in that city.

—— The work of clearing away the overhead wires in the streets of New York is being pushed rapidly forward in accordance with the recent understanding with the Mayor.

—— The Dubuque Electric Railway, Light and Power Company, of Dubuque, Ia., filed a mortgage for $200,000 recently, to secure six per cent. bonds to that amount, running till 1897.

—— Athens, Ga., is agitating the subject of more electric light, and proposes to use water power. R. L. Bloomfield, president of the Athens Manufacturing Company, is much interested.

—— It is rumored that a powerful syndicate of New York capitalists is gradually absorbing all the electric light companies in central New Jersey, taking in all the towns between Elizabeth and Plainfield.

## On the Law of Hysteresis.

A PAPER READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, JANUARY 19, 1892, BY CHARLES PROTEUS STEINMETZ.

(*Continued from page 337, Vol. XIX.*)

In Table XII, I have given a number of experimental values of the consumption of energy by hysteresis, and believe to have shown that this consumption of energy can fairly well be expressed by the empirical formula,

$$H = \eta B^x$$

where the exponent x is equal, or at least very nearly, to 1.6, and the co-efficient $\eta$ a constant of the material, which ranges from .002 up to .025 and more, and may possibly have a slight dependence upon the *velocity* wherewith the magnetic cycle is performed, as the second set of alternate current readings seems to indicate.

TABLE XII.

$$W = \gamma H^{1.6}$$

$W$ in watts per cubic inch and 100 complete periods per second.

$H$ in lines of magnetic force per square inch.

| $\gamma$ | $H$ = | 10,000 | 20,000 | 30,000 | 40,000 | 50,000 | 60,000 | 70,000 | 80,000 | 90,000 | 100,000 | 110,000 | 120,000 | 150,000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $W = 10^{-10} \times$ | | | | | | | | | | | | | |
| Very soft iron wire (Ewing) | 106 | .042 | .13 | .24 | .38 | .55 | .73 | .94 | 1.16 | 1.40 | 1.66 | 1.94 | 2.23 | 3.18 |
| Westinghouse converter, sheet iron | 201 | .061 | .15 | .29 | .46 | .66 | .89 | 1.14 | 1.41 | 1.70 | 2.01 | 2.34 | 2.69 | 3.84 |
| Very thin sheet iron | 249 | .063 | .19 | .36 | .58 | .82 | 1.10 | 1.41 | 1.74 | 2.11 | 2.49 | 2.90 | 3.34 | 4.77 |
| Thick sheet iron | 277 | .070 | .21 | .40 | .64 | .91 | 1.22 | 1.56 | 1.94 | 2.34 | 2.77 | 3.22 | 3.71 | 5.30 |
| Sheet iron | 350 | .080 | .27 | .50 | .81 | 1.15 | 1.55 | 1.98 | 2.45 | 2.96 | 3.50 | 4.07 | 4.69 | 6.69 |
| Sheet iron | 374 | .095 | .29 | .54 | .87 | 1.23 | 1.66 | 2.12 | 2.62 | 3.17 | 3.75 | 4.36 | 5.02 | 7.17 |
| Soft annealed cast steel | 663 | .17 | .51 | .97 | 1.53 | 2.19 | 2.93 | 3.75 | 4.64 | 5.60 | 6.63 | 7.73 | 8.88 | 12.7 |
| Tool steel, soft | 778 | .20 | .59 | 1.14 | 1.80 | 2.57 | 3.44 | 4.40 | 5.45 | 6.57 | 7.78 | 9.06 | 1.04 | 14.9 |
| Cast steel of low susceptibility | 994 | .25 | .76 | 1.45 | 2.30 | 3.28 | 4.39 | 5.62 | 6 95 | 8.39 | 9.94 | 11.6 | 13.3 | 19.0 |
| Cast iron | 1346 | .34 | 1.02 | 1.96 | 3.11 | 4.44 | 5.94 | 7.60 | 9.41 | 10.9 | 13.4 | 15.7 | 17.6 | 25.8 |
| Hardened cast steel | 2077 | .52 | 1.58 | 3.03 | 4.80 | 6.85 | 9.18 | 11.7 | 14.6 | 17.5 | 20.7 | 24.2 | 27.8 | 39.8 |

$H = 25{,}000$; alternate current transformer, American style (high frequency).

$H = 35{,}000$; alternate current transformer, European style (low frequency).

Only the values smaller than .25 $W$, can be of practical use; in those larger than 10 the iron gets at least red hot if in larger quantities.

In the following table I give the values of the hysteretic resistance $\eta$ for some iron samples, subjected to a magnetic cycle between $F = +190$ and $-190$ ampere turns per centimetre, calculated from Hopkinson's tests* by the assumption of the law of hysteresis $\eta$ denotes the co-efficient of hysteresis.

$B$ the maximum magnetization in lines of magnetic force per square centimetre.

$R$ the remanent magnetization in lines of magnetic force per square centimetre.

* From "Kalender fur Electrotechniker," by Upperhorn, Berlin, Germany.

These values of the hysteretic resistance vary from .002 up to .082, 41 times the first value.

But especially marked is, that $\eta$ depends much less upon the chemical constitution of the iron sample, than upon its physical condition, *annealing decreasing* and *hardening increasing* the hysteresis very considerably.

So far as the chemical constitution is concerned, the purer the iron the lower is its hysteresis, while any kind of foreign matter increases the hysteresis. Especially manganese increases the hysteretic loss enormously, much less wolfram and chronium, least silicon and carbon. Connected with the increase of hysteresis is always a decrease in susceptibility.

I wish to add a few remarks on two alleged phenomena connected with hysteresis, which have been talked about considerably without yet being made clear—the decrease of hysteresis for open magnetic circuit, and the decrease of hysteresis of a transformer with increasing load.

With regard to the first, as shown, actual tests do not show a smaller value of hysteresis for open than for closed magnetic circuit.

And it cannot be understood how that could be.

For consider an iron molecule of the magnetic circuit exposed to the harmonically varying magneto-motive force, and performing a magnetic cycle. Evidently it can make no difference for this iron molecule, whether some trillion molecules farther away, the magnetic circuit ends in air, or is closed entirely in iron, supposed that the magneto-motive force and the magnetism, and therefore also the magnetic reluctance, are the same in both cases.

Neither can it make any difference whether the magneto-motive force is caused only by one sine wave of electric current, or is the resultant of several magneto-motive forces, as in the loaded transformer. It is the same as with the electric current, where the energy converted into heat in each molecule of the conductor does not depend either, whether the material of the conductor on some other point changes, or whether one or more electromotive forces are acting upon the circuit.

Hence, until absolutely exact and undoubtable determinations of the hysteretic loss for fully loaded transformers are at hand, the assumption of a decrease of hysteresis with increasing load must be rejected.

That an apparent decrease with increasing load has been observed several times may be conceded, for, besides the exceedingly great liability to errors in these tests, where the hysteretic loss comes out as the small difference of two large values, primary energy and secondary energy, and therefore is very much affected by the slightest error in one of the components, it must be understood that the main possible errors in the determinations on fully loaded transformers all point this way. Neglection of secondary self-induction, decrease of magnetization with increasing load, slowing down of the dynamo-alternator, etc., all cause an apparent decrease in the hysteretic loss for increasing load. At least in one set of tests, those made by Professor Ryan, at Cornell University, on a small Westinghouse converter, I was able to show, in my "Elementary Geometrical Theory of the Alternate Current Transformer," that the observed decrease of the hysteretic loss disappears by reducing the different readings to the same magnetization and the same frequency.*

If, indeed, the shape of the wave of magneto-motive force varies, then a certain difference in the value of the hysteretic loss can be imagined. Compare it with a mechanical or elastic cycle. A moving pendulum, or an oscillating spring, for instance, continuously converts potential energy into kinetic energy and back; in each oscillation consuming, that is, converting into heat, a part of the energy by internal and external friction. Now, if this motion of spring or pendulum is truly harmonic, less energy is converted into heat than if the motion varies abruptly, is jerking, etc. So, in a magnetic cycle, between the same limits of magnetization the hysteretic loss might be smallest, when the cycle is entirely harmonical, but might be larger if the magneto-motive force varies abruptly, for instance, when caused by an intermittent current.

Now, in a transformer with open secondary the magneto-motive force acting upon the iron is that of the primary current, and this current is rigidly determined in its shape by the electromotive force of the dynamo and the electromotive force of self-induction. But in a fully loaded transformer the secondary current is proportional to the changes of the magnetism, therefore increases very considerably in the moment of a sudden change of magnetism. Hence, if a sudden and abrupt change in the primary current occurs, just as suddenly the secondary current increases in the opposite direction, and thereby makes a sudden change of resulting magneto-motor force and magnetism impossible, so that the fully loaded transformer compares with the elastic spring which oscillates freely, while the open-circuited transformer compares with a spring, where the motion is determined by a rigidly-acting outside force.

Hence, if the shape of the alternating primary current differs considerably from the sine law, a certain decrease of the hysteretic loss for increasing load can be expected, though certainly not such an enormous decrease as some former tests seemed to point out. These tests must undoubtedly have given erroneous results, perhaps caused by the neglection of the secondary self-induction, which, even if very small and causing only a slight error in the secondary energy, must cause an enormous error in the hysteretic loss, the small difference between the two large values—primary and secondary energy.

That an electro-magnet without keeper loses its magnetism quicker than a magnet with keeper, or a closed magnetized iron ring, is a phenomenon which has nothing whatever to do with this loss of energy by hysteresis, but is merely due to the demagnetizing force of the remanent magnetism. For the remanent magnetism in an open magnetic circuit causes between its poles a certain difference of magnetic potential, which in the moment of breaking the electric circuit acts as demagnetizing magneto-motive force, and, if the coercitive force is small, as in wrought iron or annealed steel, almost entirely destroys the remanent mag-

* The latest tests of Ewing prove that in a fully loaded transformer the loss by hysteresis is *not* smaller than for open secondary circuit.

TABLE XI.

$$H = \eta B^{1.6} \quad [+ \varepsilon N B^2]$$

$H$ in ergs per cycle and cm.$^3$ $B$ in lines of magnetic force per cm.$^2$ $F$ in ampere turns per cm.

| Material | Hysteretic co-efficient, $\eta$ | Magnetization at the M. M. F. $F = 10$ | $= 40$ | $= 90$ | Residual Magnetism $R$ For $F = 40$ | $= 90$ | Corrective Force $C$. For $F = 40$ | $= 90$ | $F = 40$ | $\frac{\eta}{C}$ for 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| Very soft iron wire (Ewing) | .0020 | 12800 | 14700 | 16600 | | | (1.5) ¶ | (1.9) | | |
| Westinghouse converter, sheet iron | .0024 | 14400 | 17800 | 20800 | | | (1.8) | (2.0) | | |
| Very thin sheet iron, standard | .0030 * | 13100 | 17100 | 20700 | | | (2.3) | (2.8) | | |
| Thick sheet iron | .00333 † | 13100 | 17500 | | | | (2.5) | (3.1) | | |
| Sheet iron | .00421 ‡ | | | | | | (3.2) | (3.9) | | |
| Sheet iron | .00450 § | | | | | | (3.4) | (4.2) | | |
| Soft annealed cast steel | .0060 | 7800 ‖ | 14000 | 16300 | 5100 | 8200 | 6.0 | 7.0 | .00133 | .00114 |
| Tool steel | .0094 | 5800 | 14800 | 18800 | 8300 | 9600 | 9.1 | 11.1 | .00103 ** | .00085 ** |
| Cast steel of low susceptibility | .0120 | 2000 | 6400 | 9800 | 2600 | 3300 | 9.1 | 11.6 | .00132 | .00104 |
| Cast iron | .0162 | 1600 | 6100 | 10100 | 2100 | 3400 | 10.4 | 15.2 | .00156 ** | .00106 |
| Hardened cast steel | .0250 | 1900 | 8000 | 12900 | 4500 | 7500 | 19.0 | 23.5 | .00132 | .00107 |
| Magnetic iron ore | .02045 | 750 | 2280 | 3290 | | 900 | | 10.0 | | .00204 |
| | | | | | | | | Average | .00132 | .00108 |

*, For $N = 100$. †, $\varepsilon = .746 \times 10^{-6}$. ‡, $\varepsilon = .2083 \times 10^{6}$. §, $\varepsilon = 1.16 \times 10^{6}$.

‖. This, and the following values of this column are derived as average of rising and decreasing branch of the magnetic characteristic, because at $F = 10$ the magnetism is still very unstable.

¶. Computed by means of the average values of $\frac{\eta}{C}$ .00132 and .0 1 8.

**, Left out by taking the average of $\frac{\eta}{C}$.

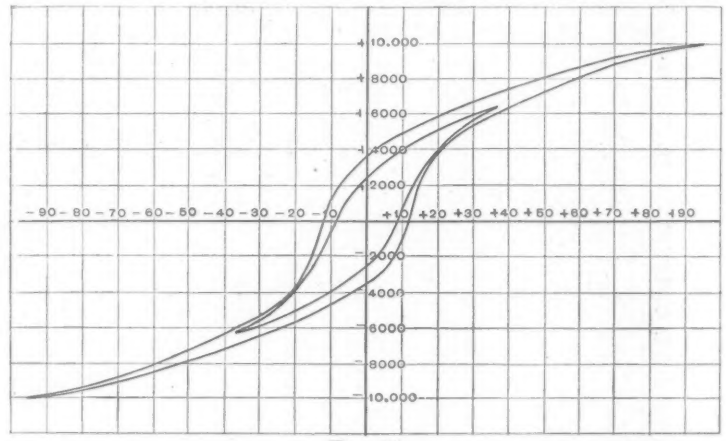



*Fig. 11.*

TABLE XIII.

| Material. | Condition. | $\eta$ | $B$ | $R$ |
|---|---|---|---|---|
| Wrought iron | Annealed | .00202 | 18,250 | 7,250 |
| Soft Bessemer steel | .04 5 per cent. C. annealed. | .00262 | 18,200 | 7,860 |
| Soft Wittworth steel | .09 " " " | .00257 | 19,840 | 7,080 |
| | .32 " " " | .00598 | 18,740 | 9,840 |
| | .89 " " " | .00786 | 16,120 | 10,740 |
| | .32 " " oil hard. | .00934 | 18,800 | 11,040 |
| | .89 " " " | .01844 | 16,120 | 8,740 |
| Silicon steel | 3.44 " Si., wrought. | .0097 | 15,150 | 11,070 |
| | 3.44 " " annealed. | .00784 | 14,700 | 8,150 |
| | 3.44 " " oil hard. | .01282 | 14,700 | 8,080 |
| Manganese steel | 4.73 " Mn., wrought. | .05963 | 4,620 | 220 |
| | 8.74 " " " | ..... | 747 | |
| | 12.36 " " " | ..... | 310 | |
| | 4.78 " " annealed. | .04146 | 10,580 | 5,850 |
| | 8.74 " " " | .08184 | 1,985 | 540 |
| | 4.73 " " oil hard. | .06706 | 4,772 | 2,160 |
| | 8.74 " " " | ..... | 733 | |
| Chrome steel | .63 " Cr., wrought. | .01179 | 15,780 | 9,320 |
| | 1.2 " " " | .01851 | 14,680 | 7,570 |
| | .63 " " annealed. | .00897 | 14,850 | 7,570 |
| | 1.2 " " " | .01638 | 13,230 | 6,490 |
| | .63 " " oil hard. | .03958 | 13,960 | 8,600 |
| | 1.2 " " " | .04442 | 12,870 | 7,890 |
| Tungsten steel | 4.65 " Wo., wrought. | .01516 | 15,720 | 10,140 |
| | 4.65 " " annealed. | .01435 | 16,500 | 11,010 |
| | 3.44 " " oil hard. | .04870 | 14,480 | 8,640 |
| | 2.35 " " very hard. | .05778 | 12,130 | 6,820 |
| Grey cast iron | 3.45 p. c. C.; 17 p. c. Mn. | .01826 | 9,160 | 3,160 |
| White cast iron | 2.04 " C.; 34 " " | .01616 | 9,340 | 5,550 |
| " " | 4.5 " C.; 8.0 " " | ..... | 385 | 77 |

netism, while in an iron of large coercitive force it affects the permanent magnetism very little. In the closed magnetic circuit the remanent magnetism causes none or very little difference of magnetic potential, and therefore no destruction of the remanent magnetism by its own demagnetizing magneto-motive force takes place. But with the hysteretic loss of energy this phenomenon has nothing to do.

To combine the results, what I believed to have proved is that loss of energy in iron caused by reversals of magnetism can be expressed by the analytical formula:

$$H = \eta\, B^{1.6}\, \varepsilon\, N\, B^2.$$

where $\eta$ is the co-efficient of hysteresis, $\varepsilon$ the co-efficient of eddy currents, $N$ the frequency of the alternatione of magnetism, $\eta B^{1.6}$ the loss of energy by hysteresis proper, or by *molecular friction*, and $\varepsilon N B^2$ the loss of energy by eddy currents, per magnetic cycle and per cm.$^3$, proportional to the frequency $N$.

TABLE XIV.

| $B$ | $B^{1.6}$ | Increase per 100. | $B$ | $B^{1.6}$ | Increase per 100. |
|---|---|---|---|---|---|
| 500 | .0208 | 42 | 13,000 | 3.821 | 46 |
| 1000 | .0631 | 85 | 13,500 | 4.060 | 47 |
| 1500 | .1206 | 115 | 14,000 | 4.303 | 48 |
| 2000 | .1913 | 142 | 14,500 | 4.580 | 49 |
| 2500 | .2732 | 164 | 15,000 | 4.807 | 50 |
| 3000 | .3659 | 185 | 15,500 | 5.062 | 51 |
| 3500 | .4684 | 205 | 16,000 | 5.429 | 53 |
| 4000 | .5800 | 223 | 16,500 | 5.598 | 54 |
| 4500 | .7000 | 240 | 17,000 | 5.870 | 55 |
| 5000 | .8288 | 258 | 17,500 | 6.148 | 56 |
| 5500 | .9662 | 275 | 18,000 | 6.434 | 57 |
| 6000 | 1.111 | 292 | 18,500 | 6.722 | 58 |
| 6500 | 1.261 | 308 | 19,000 | 7 017 | 59 |
| 7000 | 1.420 | 324 | 19,500 | 7.312 | 59 |
| 7500 | 1.583 | 339 | 20,000 | 7.613 | 60 |
| 8000 | 1.758 | 353 | 22,000 | 8.868 | 63 |
| 8500 | 1.936 | 366 | 24,000 | 10.193 | 66 |
| 9000 | 2.122 | 378 | 26,000 | 11.59 | 70 |
| 9500 | 2.313 | 389 | 28,000 | 13.05 | 73 |
| 10,000 | 2.511 | 400 | 30,000 | 14.57 | 76 |
| 10,500 | 2.716 | 41 | 35,000 | 18.65 | 82 |
| 11,000 | 2.925 | 42 | 40,000 | 23.09 | 89 |
| 11,500 | 3.141 | 43 | 45,000 | 27.87 | 96 |
| 12,000 | 3.363 | 44 | 50,000 | 33.00 | 103 |
| 12,500 | 3.589 | 45 | | | |

For convenience, I give in Table XIV, the values of the 1.6th motive power of the numbers, from 500 to 50,000 with the parts proportional, or the increase of $B^{1.6}$ for 100 lines of magnetic force.

## LITERARY.

We take occasion to acknowledge the receipt of Vol. XII, 1891, of the Transactions of the American Society of Mechanical Engineers. The matter is very interesting and is well edited.

"Edisonia," by T. C. Martin, published by the Edison General Electric Company, New York, is an artistic *resumé* of this company's immense business. The illustrations are especially handsome.

*Scribner's Magazine* for February contains eight illustrated articles representing the work of Robert Blum, W. L. Metcalf, Irving R. Wiles, J. H. Twachtman, W. L. Taylor, and other skillful artists.

A most unique magazine is the February *Ladies' Home Journal*, entirely made up, as it is, in prose, verse and fiction by daughters of famous parentage, some of the "daughters" being famed themselves.

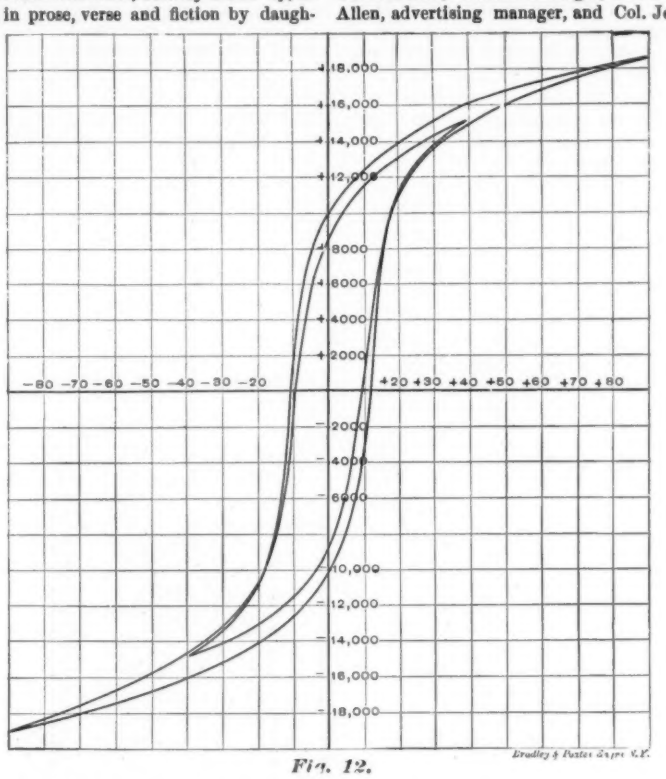



*Fig. 12.*

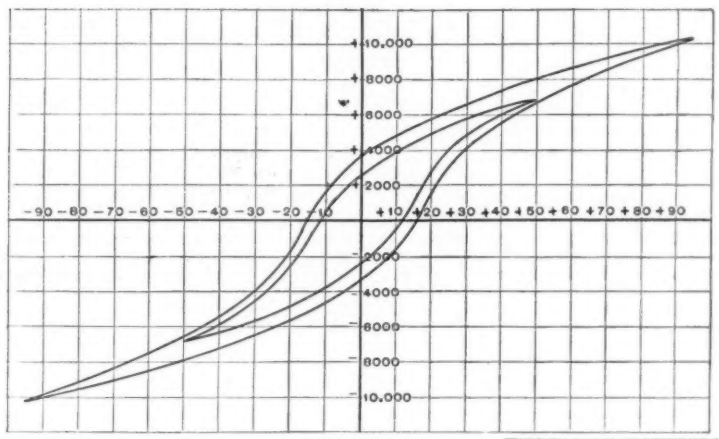



*Fig. 13.*

*The Bulletin de la Société Internationale des Électriciens*, Paris imprint, with supplement, has been received and contains some particularly interesting data on the subject of electrical machinery for use in mining.

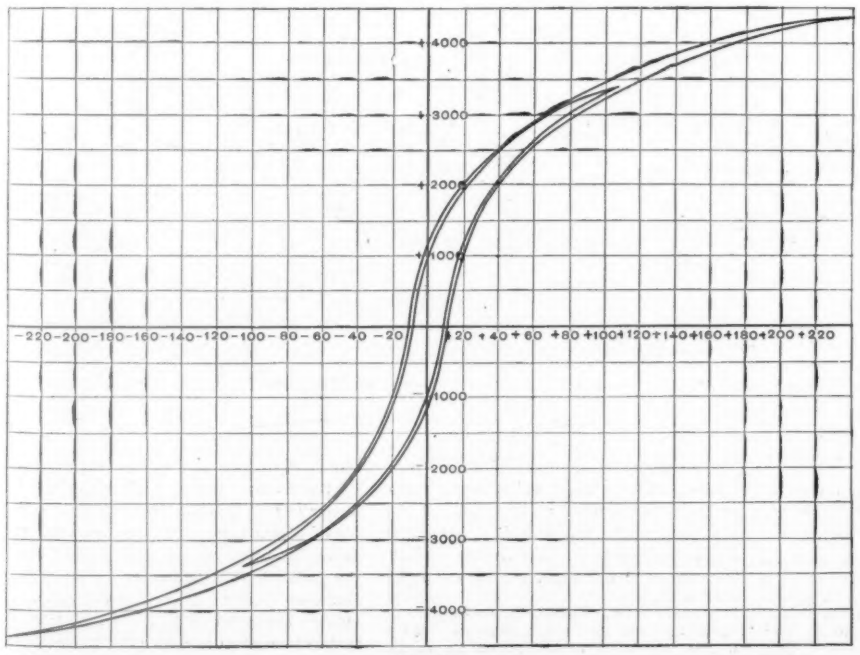



*Fig. 14.*

Our esteemed industrial contemporary, *Dixie*, of Atlanta, Ga., appears this month under a new management, consisting of Col. T. H. Martin, business manager, Col. J. H. Allen, advertising manager, and Col. John Temple Graves, editor. *Dixie* is the standard industrial journal of the South, and its reputation as an honest exponent of Southern interests will, no doubt, be maintained and added to by new energy and usefulness in the future.

We acknowledge the receipt of the proceedings of the electrical section of the Franklin Institute, Vol. 1, 1891, and the transactions of the American Institute of Electrical Engineers for the month of December, 1891.

As one looks over the pages of the February *St. Nicholas*, at every moment the eye is attracted by some bright thought in text or drawing. At the very front door comes J. H. Dolph's clever dog and cat picture, showing a plump puppy, evidently fed to repletion graciously consenting to the disposal of his dinner by his friends the kittens. Whoever gives away what he doesn't want may read the parable with the thought "*de te fabula narratur.*"

Dr. J. Mount Bleyer, of New York, has contributed MSS. to a presentation volume to be given to Herrn Geheimen Medicinalrath, Prof. Dr. Thiersch, at his jubiläum of the twenty-fifth year of his occupying the chair in surgery at the Leipsig University, and to his seventieth year and birthday to be held in May. The article was upon original researches made with the phonograph and micro-graphophone in medicine and other sciences, with its history and many illustrations accompanying it. The contribution is said to be of great interest and, in fact, is said to be an abstract from his unpublished work.

The most timely article in the February *Century* is the one written by Mr. C. C. Buel, assistant editor of the magazine, which records the results of a personal investigation by him, in behalf of the readers of *The Century*, into the history, methods, and designs of a just now notorious institution. The title of the paper is "The Degradation of a State; or, the Charitable Career of the Louisiana Lottery." Mr. Buel goes back to the time when the lottery interests of the country were centered in New York city, and shows that the Louisiana Lottery was established for the benefit of New York gamblers and lottery dealers. The article describes the people who have been the chief beneficiaries of this extensive gambling institution, and exposes the methods of bribery and political corruption by which the franchise was obtained, is maintained, and, as is now feared, is to be extended. This number is also made notable by a posthumus story by Wolcott Balestier, who is the co-author with Mr. Kipling of "Naulahka." "Reffey" is novel in plot and situation, the principal characters being a conductor on a far Western railroad, and two young women, one the manager of an eating-house, and the other a telegraph operator. Mr. Balestier's friends consider this story a justification of the high hopes that were entertained for the future.

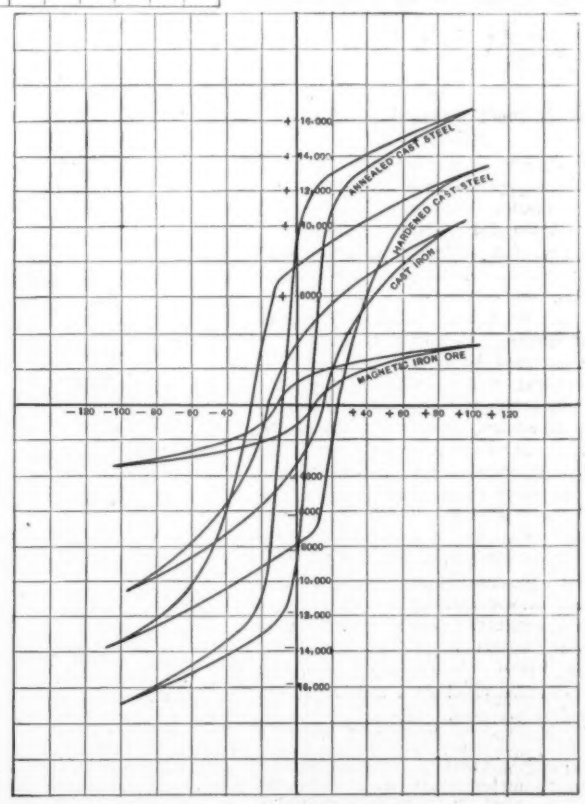



*Fig. 15.*

## THE ELECTRIC SPECIAL.

THE TRIP OF THE CONVENTION DELEGATES OVER THE NEW YORK CENTRAL TO BUFFALO—THE BOSTON CONTINGENT MET AT ALBANY.

One of the finest trains ever sent over the New York Central road was the electric special which left the Grand Central station at 11 A. M. Monday, carrying the New York delegates to the Electric Light Convention at Buffalo. The train was made up of one of the Central's fast passenger engines, a buffet smoker, the drawing room cars "Saranac," "Tupper Lake" and "Osiris," a dining car and the drawing room car "Isis." All these cars were of the latest and handsomest designs, built by the Wagner Palace Car Company. The arrangements for this train were made by Mr. C. O. Baker, Jr., master of transportation for the National Electric Light Association, Messrs. George H. Daniels and Milton C. Roach, of the New York Central, and Messrs. C. D. Flagg and J. C. Yager, of the Wagner Company.

The Boston delegation were picked up at Albany in the afternoon. The buffet car was used as general headquarters by the gentlemen, while the car "Isis" was reserved for the ladies. The New York Mandolin Club discoursed sweet music at intervals during the day.

Mr. Baker had provided an itinerary of the trip, in which appeared a short sketch of the Association and its founding by the ELECTRICAL REVIEW.

The trip along the shore of the beautiful Hudson was much enjoyed, the smooth roadbed of the New York Central adding much to the pleasure of the journey. The train arrived on time at Buffalo.

Among those who were on the train were the following: Carl Hering, Edward Caldwell, L. H. Hart, J. Stanford Brown, R. R. Whitehead, C. A. Schieren, Jr., E. P. Atkinson, George T. Manson, B. R. Western, C. A. Learned, J. C. Pierrez, S. W. Hume, W. T. Cullen, C. H. McIntire, E. F. Peck, P. H. Alexander, A. H. Mainwaring, L. W. Collins, Joseph Wetzler, F. R. Colvin, G. M. Phelps, E. E. Wood, Mr. and Mrs. W. J. Johnston, A. J. Jones, W. M. Andrus, H. Ward Leonard, A. A. Crugson, E. L. Ross, D. L. Hungerford, W. F. Osborne, J. B. Edson, Stephen L. Coles, F. H. Sparling, of New York; Allen R. Foote, J. M. James and Hon. Fred. W. Royce, of Washington, D. C.; J. M. Orford, Bridgeport; E. E. Ries, Baltimore; A. E. Braddell, Philadelphia; Mr. and Mrs. James Ferguson, Brooklyn; Mr. and Mrs. C. O. Baker, Jr., Newark, N. J.; G. M. Lee, Little Falls, N. Y.; P. H. Van der Weyde, Brooklyn; Capt. Wm. Brophy, Boston; Mr. and Mrs. M. C. Roach, New York.

## The Edison-Thomson-Houston Consolidation.

On Saturday of last week several of the New York papers contained sensational articles in relation to the recently announced consolidation of the Edison General Electric Company, of New York, and the Thomson-Houston Electric Company, of Boston.

These articles started in with the statement that Mr. Edison was being frozen out of his interest. A meeting was reported to have occurred between Mr. Edison, Mr. Villard, the president of the Edison Company, and Mr. S. Insull, vice-president of the same company, at which charges of mismanagement were said to have been freely made. Mr. Edison, it was stated, said that the scheme of the consolidation had been carried out before he was fully aware what was being done, and said he never expected to be in a position where he would have to submit to the dictation of Wall street manipulators. It was reported that he would retire from the consolidation and organize an opposition company.

Mr. Edison was interviewed Saturday afternoon and stated *per contra* that he was entirely satisfied with the consolidation, that he was the first to sign the transfer of stocks and that he had no intention of starting a new company. The officers of the consolidated companies will probably be H. McK. Twombley, president; C. A. Coffin, general manager, and Capt. Eugene Griffin, assistant general manager.

## Queen & Company's New Thomson Reflecting Galvanometer.

Messrs. Queen & Company, of Philadelphia, have just added another to the list of high grade electrical test instruments of their manufacture, for which they have justly acquired a national reputation. In the Thomson reflecting astatic galvanometer with four coils, described here, Queen & Company lay claim to nothing more than to having combined all the best features of construction suggested by theory or embodied in other instruments. In designing the instrument four objects were held in view as necessary to attain: First, maximum insulation of the strictly electrical portions of the instrument; second, maximum sensibility; third, application to a wide range of use; fourth, convenience in adjustment and quickness in working.

To attain the first *desideratum*, that of high insulation, the entire frame work of the instrument, to which are fastened the coils proper, has been supported by two highly polished corrugated rubber pillars, each 3½ inches in height. The terminal binding posts of the coils, instead of being screwed direct to the base, are so arranged that they go direct to the coils themselves without touching the base or outside case of the instrument. To effect this these posts are attached to the ends of four long rods about $\frac{5}{16}$ inch in diameter; these rods pass down through holes in the top of the case to brass lugs attached to the coil frames proper. Into these lugs, which form the terminals of the coils, the four rods screw. The holes in the top of the case through which the rods pass are somewhat larger than the rods themselves; a small hard rubber collar fits over these rods and slips down over them so as to fill these holes when the instrument is not in use, thus keeping the dust out; when the instrument is to be used these collars are slipped up, leaving the binding post rods entirely insulated from the case by an air space.

To secure maximum sensibility the upper and lower sets of coils have been separated a little more than usual and the mirror placed between the coils. To secure even greater sensibility the bounding surfaces of the coils have been carefully calculated and the wire "graded."

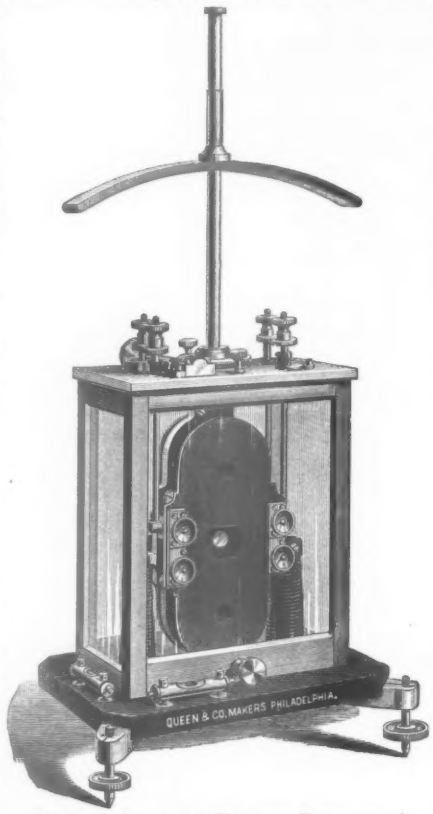
All parts of this galvanometer are made exactly to gauge, and the coils are so arranged that they can be easily and quickly taken off and replaced by others of a lower or higher resistance.

The old box level usually employed has been discarded; this on account of the fact that they cannot be made to hold their contents and require to be refilled from time to time. In place of the box level are two hermetically sealed and brass encased spirit levels set at right angles to one another.

Other portions of the instrument are much the same as in the usual patterns. A control magnet is arranged to slip up or down the tube and has a delicate tangent screw which may be rotated about the central axis of the instrument.

This galvanometer has been completed for several months, but Queen & Company would not allow it to be sold until their tests upon it were thoroughly completed. These tests have now, however, all been made and full information will be furnished to those desiring it.

It is expected that these new instruments will find a large sale among manufacturers of insulated wires and cables, as well as among colleges and scientific laboratories, and to supply the demand Queen & Company have made up a number of different resistances which they can supply promptly. Messrs. Queen & Company also have new and improved tripod galvanometer lately made, which they are now testing, and which they hope to be able to place before the public very shortly.




QUEEN & COMPANY'S THOMSON REFLECTING GALVANOMETER.

## Death of Eugene T. Lynch, Jr.

Eugene T. Lynch, Jr., died on Friday at Memphis, Tenn., where he had been engaged as an electrical engineer. His horse fell with him some weeks ago, and the injuries then received proved fatal. He was an excellent lawn tennis and football player, and in his time a member of the Columbia College University crew. He was fond of all manly exercises, and he keenly enjoyed the life which has thus suddenly ended in his thirtieth year.

Mr. Lynch was well known in electric lighting circles, and was for several years a member of the executive committee of the National Electric Light Association.

## N. I. R. Seamless Insulation.

The wires and cables manufactured by the National India Rubber Company, of Bristol, R. I., are now so well known and appreciated by the trade, that this company is building a new plant which will increase its capacity four times.

Twenty-five years of experience with india rubber has given the company a thorough and minute knowledge of the manipulation of rubber in all its branches, and its application as insulation for electric wires is no new thing with them, for 18 years ago they applied rubber covering to wires for their own use, which wires are in use to-day with unimpaired insulation.

For a number of years Col. A. C. Eddy and other officers of the company have been experimenting with rubber insulation, in conjunction with electrical experts, in the endeavor to produce a superior insulating covering.

The Massachusetts Electrical Engineering Company, of Boston, has been associated in these later tests, which have proved that only the best and most carefully prepared rubber compound will make a good and lasting insulation.

The N. I. R. insulation possesses high insulating qualities, and is claimed to be less susceptible to the destructive influences of heat, cold, moisture and gases, than that used by other companies. Pure lake copper and fine Para rubber are used.

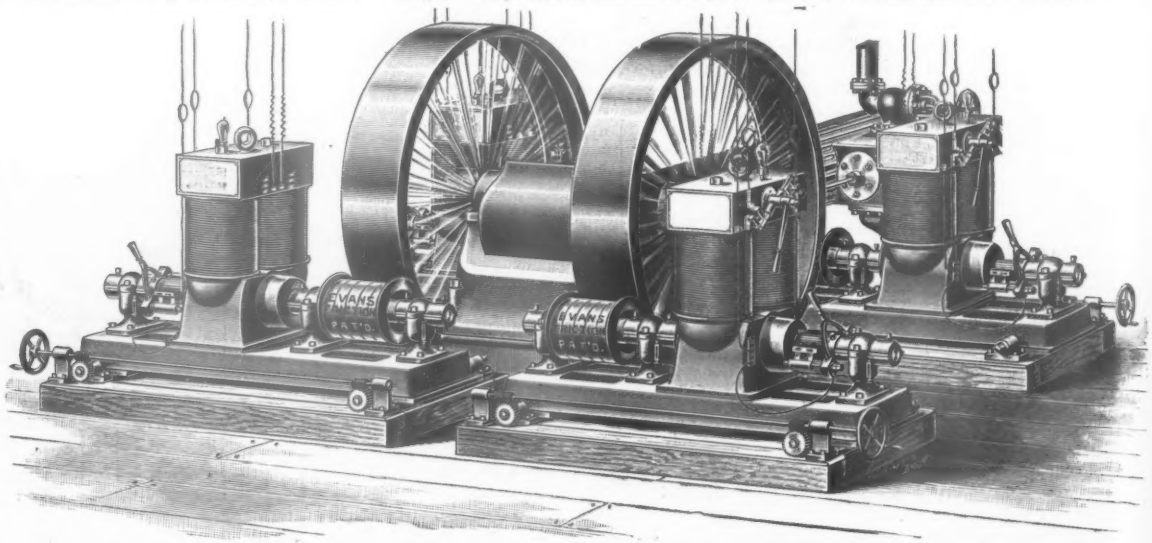
The rubber covering is first pressed around the wire in a semi-plastic form, making a seamless covering, which is considered an important advantage over insulation having a seam on one or both sides. It is then wound with rubber tape and covered with a braided weatherproof outer envelope. The whole insulation is then vulcanized. The wire is made with a black finish, or with a white fire-proof finish, as desired.

Telephone and telegraph wires, switch cords, electric light and underground lead covered cables are made in all the sizes called for with a standard insulation resistance of 1,000 megohms per mile. A large quantity of these lead covered electric light cables are in use in the New York city subways.

Samuel P. Colt is president of the National India Rubber Company, and F. S. Minott is manager of the wire department.

## The Evans Friction System of Driving Dynamos.

A device of great importance in an electric light or power plant where economy of space is necessary or desirable is the Evans friction system of driving dynamos, manufactured by the Evans Friction Cone Company, 85 Water street, Boston, Mass. A large number of plants have been provided with this device, among those recently equipped being the isolated lighting plant in the Wells Building, Boston. Here four Edison dynamos are being driven by the Evans friction system in connection with a 200 horse-power McIntosh & Seymour engine. The economy in floor space, and the convenience of operating each dynamo separately, are so apparent as not to require further explanation.



THE EVANS FRICTION SYSTEM OF DRIVING DYNAMOS, AS INSTALLED IN THE WELLS BUILDING, BOSTON.

### Holtzer-Cabot Apparatus.

The Holtzer-Cabot Electric Company, of Boston, have recently developed and improved the electrical apparatus illustrated herewith. One of our illustrations shows a fan motor designed by this firm which is almost noiseless, and is designed to run at

FIG. 1.—¼ HORSE-POWER HOLTZER-CABOT MOTOR.

from 1,200 to 2,200 revolutions per minute. This motor is adapted to circuits carrying from 110 to 500 volts. The motor has self-oiling bearings, and is arranged to carry one 15 inch or two 12-inch fans, one on each end of the shaft. The motors are equipped with copper or carbon brushes, are elegantly finished, and finely made. The regulation of speed is obtained by moving the switch on the base.

The Holtzer-Cabot Electric Company also make small dynamos, ranging in capacity

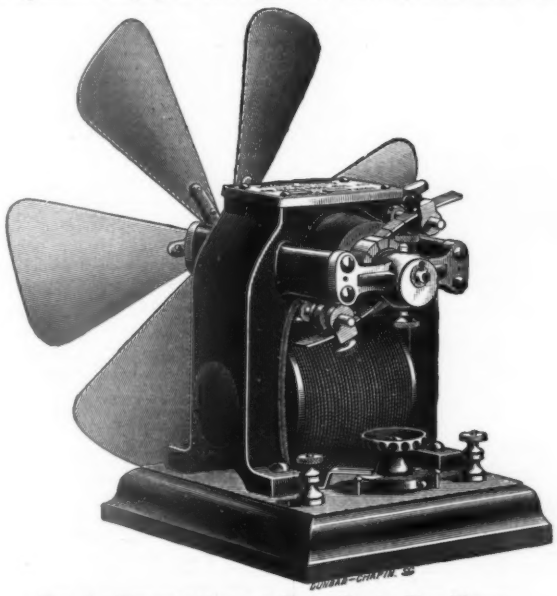


FIG. 4.—HOLTZER-CABOT ¼ HORSE-POWER FAN MOTOR.

from two to 16 lights of 16 candle-power each at 110 volts. These dynamos may also be used for electroplating and electrotyping. They are automatic, highly efficient, and are equipped with self-oiling bearings. The one-sixth horse-power generator is also made with a double winding in the armature so as to generate an alternating current which will ring through 25,000 ohms resistance for testing purposes.

Another of our illustrations shows the Holtzer-Cabot starting box for one-quarter, one-half and one horse-power motors. It has a polished slate front, and the iron work is well japanned. The brass parts are highly polished and the whole device is well made.

The one-quarter, one-half and one horse-power Holtzer-Cabot motors embody the latest improvements in motor construction. They are very slow speed and are equipped with either drum or cylinder armatures, the type varying according to the size and style of the motor. The commutators are of hard drawn copper insulated with mica. The armatures are positively driven throughout their length and not from one end. The armature winding is embedded below the surface of the core. The rocker arms and brush holders are free to swing around an entire circle, enabling the armature to run in either direction. Larger sizes of these motors will soon be put upon the market.

### Electric Heating.

TO THE EDITOR OF ELECTRICAL REVIEW:

In justice to the cause of electrical heating, and incidentally to myself, I respectfully submit the following in answer to Mr. Owens' communication published in your issue of February 13. I quote from his letter: "I would respectfully call the attention of your readers to the fact that he has compared 'cost of stove heat' with the cost only of the 'coal' to make the 'electric heat' (if I may use the term)." While in the case of electrical heat, I indicated the process by which a result was arrived at and called the result "cost per car day," I think it is a natural supposition that, although I termed the other "cost of stove heat," I named a result reached by a parallel course of reasoning indicating simply the cost of coal consumed.

Mr. Owens adds: "He further allows us to infer that the heats made in the two cases are the same." I disclaim any intention of influencing anyone to wrong inferences. Furthermore, I consider it everybody's privilege to make whatever inferences their intelligence may direct. However, that which Mr. Owens gives me credit for allowing I hitherto have considered not as an inference, but rather as the common basis of the comparison. In explanation I may say that perfect accuracy is not adhered to in allowing that as a basis for the comparison. It is true to the extent that, assuming a car stove will comfortably warm a car, electrical heaters will equal it in results. I did not deem it necessary to mention the familiar fact that a stove-heated car is often uncomfortably warm near the stove and uncomfortably cold near the doors; nor did I mention the less familiar, but not less true fact, that an electrically heated car is comfortable in every part, due to the arrangement of the heaters. Since it is unnecessary, if for no other reason, questionable methods are not resorted to for furthering the distribution of electrical heaters. The device has merits which are winning for it an enviable place in the list of useful inventions.

I agree with Mr. Owens that the "cost of coal is not all that must be considered when we estimate the relative values of various systems of heating," but I do not see how a consideration of the points mentioned can lend strength to the objections raised to the use of electrical heaters. The life of an electrical heater will equal that of a car; the only injury possible to it is the oxidation of the resistance wire, which ordinary care will prevent. Three minutes of a conductor's day is sufficient to operate the heaters. The wear to plant and line will only be the imperceptibly increased wear on engine and generator parts. The life of a stove, on the other hand, is not over three years, while the renewal of worn out parts is a continual expense. Moreover, a stove requires frequent attention to give satisfactory results.

Mr. Owens suggests that if certain facts were borne in mind by "writers on electric heaters fewer such ridiculous comparisons would be made between electric heaters and coal stoves." Since it is not, and probably never can be so, is it likely that for practical purposes anyone will assume that furnaces and engines are operating at 100 per cent. efficiency or at any per cent., in fact, higher than the accepted average? It seems ridiculous to affirm that the calculations given in my letter were made under local conditions and, although I do not know the exact efficiency of boilers and engines, I do not believe it was reckoned what the result would be in case they were operating at 100 per cent. efficiency. Furthermore, has not the circumstance of a person intimating that he himself comprises a minority which alone has taken into proper consideration the relative efficiency of boilers and furnaces a ridiculous aspect? It is unnecessary to prolong this letter with an explanation of how an electrical heater can have an efficiency of less than 100 per cent. or of how it can be increased. If Mr. Owens seriously desires such information, I can favor him in a less public manner.

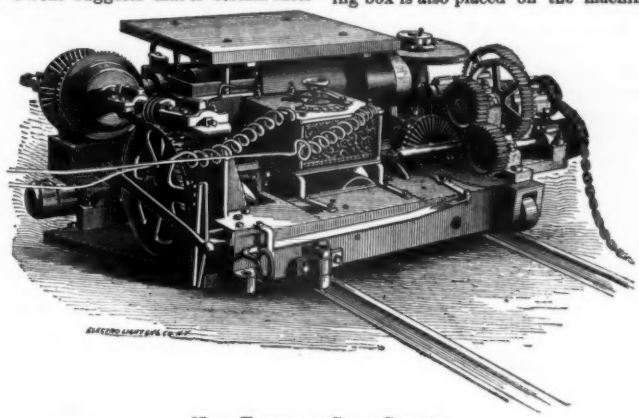
Yours truly,

W. R. B. WILLCOX.

Chicago, Feb. 18.

### "C. & C." Electric Coal Cutter.

The accompanying cut illustrates a coal cutter of the undercutting type, driven by a 15 horse-power "C. & C." electric motor of special design. This is in operation in the Mead Run mine in the State of Pennsylvania. The motor placed in position on the machine is covered by a heavy board which serves to protect it from possible injury from any heavy object falling upon it. The starting box is also placed on the machine in a convenient position, as can be seen from the illustration. The armature shaft carries a beveled pinion at each end, and by a mechanical device this can be made to operate the endless chain to which the coal cutting knives are attached, and which revolves about the arm, and also to operate the feed chain, which is made fast at one end, so that the machine can be moved forward at any desired speed or allowed to remain stationary if the hardness of the coal so requires. The potential of the electric motor being low, 220 volts, there is no danger to be feared from coming in contact with the wires.



NEW ELECTRIC COAL CUTTER.

The knives used for cutting are of the greatest durability, and when dulled can readily be replaced by a new set. By using this style of machine the necessity and inconvenience of moving by hand in a low room is avoided and the track on which it runs is such that it can be easily moved or laid as desired.

The Thomson-Houston Electric Company have found this machine so successful in mines where an undercutting machine can be used to advantage, that they have made an arrangement for its adoption, and it is expected that several mining machinery manufacturers will do the same.

FIG. 2.—HOLTZER-CABOT STARTING BOX.

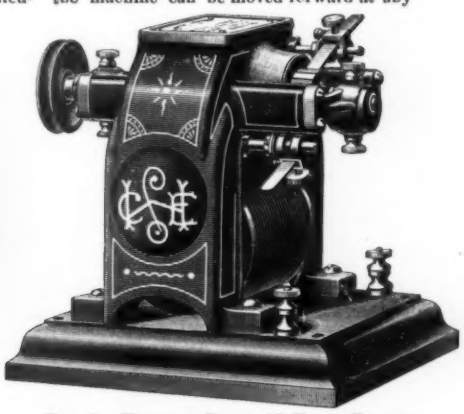


FIG. 3.—HOLTZER-CABOT 16 HORSE-POWER GENERATOR.

FIG. 5.—HOLTZER-CABOT 1 HORSE-POWER MOTOR.

## KINDRED INTERESTS

**The Brush Electric Company,** Cleveland, O., recently sold to the Laclede Gas Light Company, St. Louis, a 2,500 light alternator.

**F. Reddaway & Co.,** of 52 New street, New York city, have issued a price list of their excellent machine belting, fire hose, etc. Their yearly production of belting exceeds 3,000,000 feet.

**Chas. A. Schieren & Company,** of 45–51 Ferry street, New York, send us a very handsome catalogue of their leather and rubber belts, etc., quite in keeping with the taste which this firm shows in the display of its wares. Much valuable information is given on the subject of belts.

**The Shipman Engine Company,** of 200 Summer street, Boston, have issued a very complete pamphlet descriptive of their well known oil engines, with the many interesting uses to which they may be put. Prices, sizes and dimensions are given, with statements of the advantages of this class of engine where small powers are required.

**The Palace Hotel,** San Francisco, Cal., have one of the largest isolated plants in the country, reaching the proportions of many central lighting plants. The power is supplied by Ball engines built by the Ball Engine Company, Erie, Pa., and consists of one 100 horse-power tandem compound engine, two 100 horse-power Cross compound engines, and two 200 horse-power Cross compound engines.

**The Interior Conduit and Insulation Company,** of 42–44 Broad street, New York city, send us a sample of their new metal covered conduit tube, which is especially designed for use in cement, under tile floors and like places, and also in finished buildings where the tubing is exposed. This wide-awake company keeps fully apace with the requirements of its business, adding improvement after improvement to its already well designed system. Contractors should send for a copy of their specifications for wiring with the interior conduit.

**Mr. I. P. Frink,** 551 Pearl street, New York, has now on hand a large number of orders for reflectors and reflecting chandeliers, in which electric lamps are used, covering all classes of public buildings, and well distributed over the States. Among them are the following prominent churches: Protestant Dutch Church, New York city; Christ Church, Jersey City, N. J.; First Presbyterian Church, Fostoria, O.; M. E. Church, Ventura, Cal.; Catholic Church, Owatonna, Minn.; Fourth Presbyterian Church, Pittsburgh, Pa.; M. E. Church, Plainfield, N. J.

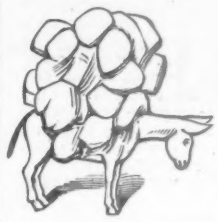
**Curtis & Curtis,** manufacturers of the Forbes patent die stocks, pipe cutting and threading machinery, of Bridgeport, Conn., have just shipped to a large heating company in Michigan one of their No. 5 pipe machines. This machine is remarkable in several respects. With its great range from 2½ to 12 inches, inclusive, both right and left, either standard pipe thread or any other number of threads to the inch can be cut. It is thought to have the largest range of any pipe machine ever built. On account of the advantages of their system and which are covered by their patents, Messrs. Curtis & Curtis, are able to build these machines much lighter and, therefore, cheaper than is usually done, the total shipping weight of this 2½ by 12 inch pipe machine being only 5,500 pounds.


## For Sale.

ELECTRICAL PRINTERS of various makes, second-hand, but in good order. For Sale very cheap.

**Apply 13 Dey street.**





Overloaded and disordered Batteries are a common and painful sight. Why? Because they are not built to work, but to sell. Are you a sufferer? Then substitute the LAW BATTERY and suffer no more.

SOLE MAKERS,

**LAW TELEPHONE CO.,**

*85 John Street,*

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DYNAMO and Motor repairing. Armatures wound for any system, at low prices. All work guaranteed. We furnish new Commutators. Agent for the "Billberg" Motor and Generator.

CORRESPONDENCE SOLICITED.

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PATENT

**PERFORATED**

**ELECTRIC LEATHER BELTING**

Runs more Slack than Unperforated Belts, hence adapted to uneven power of Electric Railways.

**CHAS. A. SCHIEREN & CO.,**

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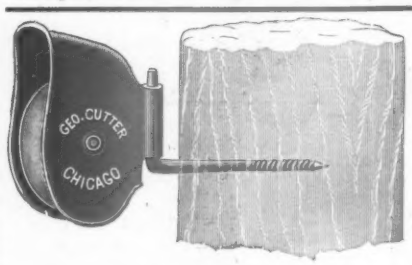


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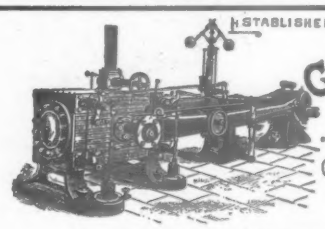

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## ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON FEBRUARY 9, 1892.

468,686 Electric governor; John T. O'Brian, Kearney, Neb.

468,690 Ring armature; John G. Pool, New Haven, Conn., assignor, by direct and mesne assignments, of three-fourths to himself, Joseph E. Hobinger and Nicholas W. Hobinger, same place.

468,697 Resetting device for annunciators; Ralph A. Schoenberg, New York, N. Y.

468,700 Device for preventing shadows of electric or other forms of lamp; James B. Sheldon, St. Louis, Mo., assignor of one-half to Hiram H. Stiebel, same place.

468,706 Magnetic extractor; Horatio W. Southworth, New York, N. Y.

468,708 Electric railway; Charles W. Thomas, Jersey City, N. J., assignor of part to Philip Van Volkenburgh, New York, and John H. Pendleton, Brooklyn, N. Y.

468,711 Electric arc lamp; Addison G. Waterhouse, Hartford, Conn.

468,716 Electric motor; James T. Wilson, Tyrone, Pa.

468,752 Rheostat; Alton J. Shaw, Muskegon, Mich.

468,753 Apparatus for stopping engines or other motors; Jacob P. Tirrell, Boston, assignor to Washington H. Kilbourn, Greenfield, Mass.

468,755 Telegraphy; William F. Wentz, Newark, N. J., assignor of one-half to Otto G. Hoerster, same place.

468,772 468,773 Insulating coupling; Louis McCarthy, Boston, Mass.

468,774 468,775 Machine for marking mail matter; Martin V. B. Etteridge, Everett, Mass., assignor to the American Postal Machine Co., Portland, Me.

FEBRUARY 16, 1892.

468,779 Trolley for electric cars; John W. Beebe, Waterloo, N. Y.

468,787 Signal for electric railway systems; Frederick A. Cheney, Elmira, N. Y.

468,818 Multiple switchboard; Walker Moseley, London, England, assignor to the Western Electric Company, Chicago, Ill.

468,880 Electrolytic cell; Ernest A. Le Sueur, Ottawa, Canada.

468,887 Electrolytic or depolarizing solution for galvanic batteries; Samuel Miller, London, England, assignor to Evelyn Glover, same place.

468,903 Electric elevator; Rudolph C. Smith, Yonkers, N. Y., assignor, by mesne assignments, to the National Co., Chicago, Ill.

468,912 Turn-table connection for electric railways; Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignments, to the Thomson-Houston Electric Co. of Connecticut.

468,917 Electric brake mechanism for elevators; Charles E. Moore, Boston, Mass.

468,938 System of distribution of electrical heating currents; George D. Burton, Foston, Mass., assignor to the Electrical Forging Co. of Maine.

468,947 Dynamometer; Edgar J. Wood, Brooklyn, N. Y.

468,948 Electrically propelled car; Harry E. Dey, Brooklyn, N. Y., assignor of one-half to Frederick B. Griswold, Hartford, Conn.

468,949 Converter system for electric railways.

468,950 Commutator brush for electric motors and dynamos; Thomas A. Edison, Llewellyn Park, N. J.

468,953 Field magnet for dynamos and motors; Robert Lindell, New York, N. Y., assignor of one-half to Edward H. Johnson, same place.

468,955 Coin feed machine for giving electric shocks; Joseph Mason, London, England.

468,959 Electric railway; Frank J. Sprague and Patrick F. O'Shaughnessy, New York, N. Y., assignors to the Sprague Electric Railway and Motor Co., same place.

468,970 Means for indicating discharge from or into hoppers; Frank H. Briggs, Cleveland, O.

469,041 Electric arc lamp; Robert S. Dobbie, Jersey City, N. J.

469,048 Suspending device for electric lamps; James J. Renehan, New Britain, Conn.

469,050 Electric search-light; Nelson Weeks, Jr., Long Island City, N. Y.

469,060 Armature for dynamo-electric machines; Marcel Deprez, Paris, France.

469,085 Telephone transmitter; Elwood A. Grisinger and Theodore Grisinger, Mechanicsburg, Pa.

469,093 Electric arc lamp; Houghton Sawyer, San Francisco, Cal.

469,135 Electric curling iron; Alexander F. Godefroy, St. Louis, Mo.


**JOHN A. BARRETT,**

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